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# NOTES ON AMERICAN WILLOWS. V

## THE SPECIES OF THE PLEONANDRAE GROUP [1]

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IN my conspectus of the Mexican species of Salix (Bot. Gaz. LXV. 1–41. 1918) I stated that I had " already made a rather extensive investigation of the forms belonging to the *Pleiandrae* [2] group (sect. *Nigrae*, *Triandrae*, *Pentandrae* subsect. *Lucidae* and *Bonplandianae*) "; I then dealt with all the forms of this group which are found from Mexico to South America. To-day I propose to give a key for the determination of all the American species and varieties of these sections, to discuss their geographical distribution, and to deal with those forms of which I have not yet spoken in my paper cited above. The *Pleonandrae* group is well defined in so far as the male plants always have more than 2 (from 3 to 15) stamens, while all the other American Salix (except of course some hybrids) have 2 stamens or only one in *S. sitchensis*, *S. Coulteri* and *S. Uva-Ursi*.

Besides the rich material of the herbarium of the Arnold Arboretum I have been able to study the collections of the Gray Herbarium and of the herbaria of the Missouri Botanic Garden, of the Field Museum, of the Geological Survey of Canada, and of the Leland Stanford University; and I have had at my disposal part of the collections of the herbaria at Kew, New York, Reno and Washington.[3] I wish to express my best thanks to

[1] The preceding parts of this series have appeared in Botanical Gazette: I. The species related to Salix arctica Pall. (Bot. Gaz. LXVI. 117–142. 1918.) — II. The species related to Salix glauca. (l. c. 318–353. 1918.) — III. A conspectus of American species and varieties of sections Reticulatae, Herbaceae, Ovalifoliae and Glaucae. (l. c. LXVII. 27–64. 1919.) — IV. The species and varieties of section Longifoliae. (l. c. 309–346. 1919.) See also A conspectus of Mexican, West Indian, Central and South American species and varieties of Salix. (Bot. Gaz. LXV. 1–41. 1918.)

[2] The name *Pleiandrae* was used by ANDERSSON (1867, 1868) but he included in his group also sect. *Fragiles* of which the male plants are diandrous. I prefer to use the spelling *Pleonandrae* of VON SEEMEN (Salic. Japon. 15. 1903) who restricts his group to the species with more than 2 stamens.

[3] In the enumeration of specimens I am using the following abbreviations: A., Herbarium of the Arnold Arboretum. — C., Herbarium of the Field Museum, Chicago. — Cal., Herbarium of California Academy of Science. — Cor., Herbarium of Cornell University. — CU., Herbarium of University of Chicago. — E., Herbarium of the University of Oregon, Eugene. — G., Gray Herbarium. — Jeps., Herbarium of Professor W. L. Jepson, Berkeley, Cal. — K., Kew Herbarium. — L., Herbarium of the University of Wyoming, Laramie, Wyo. — M., Herbarium of the Missouri Botanic Garden. — N., Herbarium of the New York Botanic Gar-

the curators of all these herbaria. For some interesting material I am indebted to Professor G. P. Clinton, New Haven, Conn., Miss A. Eastwood, San Francisco, Professor J. K. Henry, Vancouver, B.C., Mr. I. M. Johnston, Upland, Cal., and last, but not least to Mr. J. C. Nelson, Salem, Ore. From the Herbarium of the University of Oregon, at Eugene, I have received the *Salix* material of the Howell Herbarium.

## CLAVIS SPECIERUM VARIETATUMQUE

Folia adulta[1] semper utrinque concoloria, viridia, linearia, lineari-lanceolata vel lanceolata, utraque facie stomatibus plus minusve aequinumerosis (tantum in quadam forma incerta *S. nigrae* paucioribus vel fere nullis) instructa; petioli (vel basis laminae) apice eglandulosi vel subeglandulosi (i.e. glandulis distinctis flavescentibus saepe irregulariter lobulatis haud praeditis, sed saepe glandulae minimae punctiformes adsunt); ramuli fragilissimi . . . . Sect. I. NIGRAE.

Ramuli annotini[2] biennesque plus minusve rufescentes vel purpurascentes; ovaria pedicellique semper glabri.

Fructus perfecte maturi[3] ovoidei vel ovoideo-oblongi, apice vix vel tantum breviter attenuati, pedicello brevi iis pleroque 4–5plo breviore glandulam circ. 2plo superante suffulti; folia linearia vel lineari-lanceolata; petioli laminae comparati satis longi; stipulae intus fere semper eglandulosae.

Flores feminei glandula tantum ventrali instructi.

Folia distincte linearia, tantum versus apicem attenuata. 1. *S. Humboldtiana.*

Folia plus minusve lineari-lanceolata, fere a basi ad apicem sensim attenuata . . . . . 1b. *S. Humboldtiana* var. *stipulacea.*

Flores feminei glandulis 2 (ventrali et dorsali) instructi. 1c. *S. Humboldtiana* var. *Martiana.*

Fructus perfecte maturi ovoideo-subrostrati, apice satis attenuati, pedicello satis variabili longitudine glandulam 2–5plo superante; folia lineari-lanceolata ad late lanceolata; petioli saepe laminae comparati breviores vel stipulae intus plus minusve glanduliferae.

Ramuli hornotini vel petioli (saltem superne) plus minusve distincte villosuli vel folia plus minusve lanceolata basi obtusa, subrotunda vel breviter acuta et petioli breves (id est quam latitudo laminae haud longiores); stipulae intus eglandulosae . . . . . 2. *S. nigra* et 2b. *S. nigra* var. *altissima.*

Ramuli petiolique citissime glabrescentes vel folia plus minusve linearia et basim versus attenuata et petioli graciles satis longi; stipulae intus glanduliferae . . . . . 2c. *S. nigra* var. *Lindheimerii.*

den. — NE., Herbarium of the New England Botanical Club. — O., Herbarium of the Geol. Surv. of Canada, Ottawa. — P., Herbarium of the Academy of Science, Philadelphia. — Pu., Herbarium of the University of Washington, Pullman, Wash. — Reno, Herbarium of the Nevada Agric. Exp. Station, Reno, Nev. — St., Herbarium of the Leland Stanford University. — W., U.S. National Herbarium, Washington, D.C. — If there is no indication of a herbarium, the specimens are in A., the herbarium of the Arnold Arboretum (and mostly also in the other herbaria). Other abbreviations are: m., male specimen. — f., female specimen in flower. — fr., fruiting specimen (im. fr. means with immature fruits). — st., sterile specimen.

[1] This refers to fully developed normal leaves towards the end of sterile branchlets or shoots. The first (lowermost) leaves of these branchlets and the leaves of the flower-bearing branchlets (peduncles) are often very different and mostly much smaller.

[2] "Annotini" is used here for the well-ripened branchlets of the previous season, while "hornotini" is used for the shoots of this year.

[3] Very often the capsules are not ripe, but have been collected unripe and have opened in drying. Hence they are frequently smaller or of a different shape. If not properly fertilized the ovaries do not develop into normal capsules, but remain much smaller and look differently.

Ramuli annotini biennesque plus minusve distincte flavescentes vel flavo-cinerei; ovaria fructusque vel pedicelli tantum saepe plus minusve villosuli; fructus ovoideo- vel anguste ellipsoideo-conici, apice plus minusve attenuati, vulgo satis longe pedicellati . . . . . 3. *S. Gooddingii.*

Folia adulta subtus discoloria, plus minusve glaucescentia vel albescentia, vel viridia (concoloria) sed superne non stomatifera vel stomatibus sparsis instructa et non lineari-lanceolata et petioli apice vel ad basim laminae distincte glanduliferi.

Petioli distincte glanduliferi, satis breves vel crassi; ramuli annotini biennesque plus minusve nitiduli; amenta mascula plus minusve breviter cylindrica, satis crassa et stricta, apice vulgo attenuata, filamentis strictis; fructus satis breviter et crasse pedicellati vel folia subtus viridescentia; ramuli ut videtur semper plus minusve valde fragiles . . Sect. III. PENTANDRAE, subsect. LUCIDAE.

Folia matura subtus distincte albescentia vel glaucescentia.

Fructus 7–12 (vulgo circ. 10) mm. longi pedicello circ. 5plo breviore excluso; folia elliptico-lanceolata, apice acuta, vix ultra 9 : 2.8 cm. (surculorum excepta) magna, superne estomatifera . . . . . 5. *S. serissima.*

Fructus 6–7.5 (rarius ad 9) mm. longi pedicello 3–5plo breviore excluso; folia apice plus minusve acuminata caudatave, ad 16 : 4 vel 19 : 2.5 cm. (eis surculorum exceptis) magna, superne estomatifera vel stomatibus paucis instructa . . . . . 6. *S. lasiandra.*

Folia matura subtus plus minusve concoloria, viridescentia (interdum pallide viridia, sed non glaucescentia).

Stomata in pagina superiore foliorum iis paginae inferioris fere aequinumerosa; folia plus minusve lanceolata et plus minusve sensim caudato-acuminata, vulgo 4–5plo longiora quam lata . 6b. *S. lasiandra*, var. *caudata.*

Stomata in pagina superiore foliorum nulla vel sparsa (rarissime ut videtur satis numerosa); folia late ovata, elliptica vel elliptico-lanceolata et semper plus minusve subito in acumen longum caudatum attenuata vel haud ultra 3½plo longiora quam lata (in. f. *angustifolia* 5–6plo longiora quam lata iis *S. lasiandrae* var. *caudatae* saepe similia sed vulgo distinctius glanduloso-serrata vel basim versus magis angustata).

Folia plus minusve late ovato- vel elliptico-lanceolata, satis subito caudato-acuminata.

Ramuli novelli foliaque novella glabra vel citissime glabrescentia. 17. *S. lucida.*

Ramuli hornotini et interdum partim annotini pubescentia sordide grisea vel rufescente praediti; folia initio satis pilosa, etiam adulta saltem in venis subtus (rufecenti-)pilosa . 7b. *S. lucida* var. *intonsa.*

Folia plus minusve anguste lanceolata, satis sensim acuminata. 7c. *S. lucida* f. *angustifolia.*

Petioli eglandulosi vel glandulis indistinctis parvis praediti, vel stomata in pagina superiore foliorum nulla et folia satis indistincte glanduloso-denticulata.

Ramuli annotini biennesque plus minusve flavescentes, non distincte rubescentes vel purpurascentes, fragiles; folia superne vulgo stomatifera vel petioli satis tenues et longi, quam lamina vix ultra 6plo breviores. Sect. II. TRIANDRAE.

Folia plus minusve lanceolata, sensim acuminata, superne stomatibus numerosis instructa; ramuli distincte flavescentes. 4b. *S. amygdaloides* var. *Wrightii.*

Folia plus minusve ovato- vel elliptico-lanceolata, satis subito acuminata; ramuli vulgo magis olivacei vel flavo-brunnei vel cinereo-fusci.

Ramuli satis flavescentes, initio ut folia novella plus minusve pilosuli. 4a. *S. amygdaloides* f. *pilosiuscula.*

Ramuli magis brunnescentes vel cinereo-fusci, ab initio ut folia glaberrimi. 4. *S. amygdaloides.*

Ramuli annotini distincte rubescentes vel purpurascentes vel tomentelli, tenaces (tantum in *S. Harbisonii* fragiles); folia superne nunquam stomatifera (vel in *S. Harbisonii* secundum costam stomatibus plus minusve sparsis praedita) . . . . . Sect. IV. BONPLANDIANAE.

Fructus satis parvi et crassi, breviter ovoideo-conici, apice vix vel paullo attenuati, 4–5 mm. longi, pedicello satis crasso 4–5plo breviore excluso, vel pedicelli (basisque fructuum) pilosi.

Ramuli annotini dense tomentosi; folia initio subtus dense villoso-tomentosula; petioli breves, vix ad 8 mm. longi; amenta mascula parva, tenuia, vix ad 3: 0.8 cm. magna; fructus conferti, circ. 4 mm. longi, basi pedicelloque pilosi . . . . . 8. *S. jaliscana.*

Ramuli annotini glabri; folia subtus semper glabra vel cito glabrescentia vel petioli foliorum majorum ultra 10 mm. longi; amenta serotina, ex axillis foliorum adultorum orientia vel coetanea, mascula vulgo 4–6 cm. longa; fructus circ. 5 mm. longi, pedicello 4–5plo breviore excluso, glabri.

Amenta serotina, autumno apparentia (vel in forma guatemalensi coetanea), mascula femineaque 4–6 (–8) cm. longa.

Ramuli novelli foliaque initio glabra . . . . 9. *S. Bonplandiana.*

Ramuli novelli foliaque initio subtus plus minusve villosula. 9b. *S. Bonplandiana* var. *pallida.*

Amenta coetanea vel breviora, vix ultra 3 cm. longa. 9c. *S. Bonplandiana* var. *Toumeyi.*

Fructus 5–9 mm. longi, apice subito vel longius attenuati vel pedicello gracili saepe tantum duplo breviore suffulti.

Stipulae in facie interiore plus minusve glanduliferae, parvae vel nullae; folia matura superne vivide viridia, nitidula, margine satis indistincte et adpresse glanduloso-denticulata; fructus vix ultra 6 mm. longi, pedicello subduplo ad 3/5plo breviore excluso.

Ramuli novelli (foliaque subtus) glabri . . . . . 10. *S. laevigata.*

Ramuli novelli (foliaque subtus plus minusve) tomentelli vel villosuli. 10a. *S. laevigata* f. *araquipa.*

Stipulae in facie interiore tantum plus minusve pilosae vel glabrae haud glanduliferae (vel in *S. Harbisonii* interdum pauciglandulosae), saepe (saltem in ramulis vegetis) satis magnae; folia matura superne pallide vel intensius sed plus minusve opace viridia, margine argutius glanduloso-serrato-denticulata; fructus 6–10 mm. longi pedicello subduplo vel duplo (rarius ad 4plo) breviore excluso.

Ramuli tenaces; folia in pagina superiore ut videtur nunquam stomatifera.

Stipulae fere semper distincte acutae vel etiam in ramulis vegetioribus minimae vel nullae; ramuli hornotini et saepe annotini plus minusve tomentelli vel villosuli vel folia majora (eis surculorum exceptis) anguste lanceolata et vix ultra 1.4 cm. lata.

Folia plus minusve late lanceolata, petioli majorum ad 1.8 cm. longi . . . . . 11. *S. longipes.*

Folia anguste lanceolata (eis surculorum exceptis) et petioli majorum vix ultra 10 mm. longi . . 11b. *S. longipes* var. *venulosa.*

Stipulae fere semper distincte obtusae rotundataeve, in ramulis sterilibus (surculis exceptis) vulgo distincte evolutae; ramuli etiam novelli glabri vel cito glabrescentes (surculi tantum saepe magis pilosi); folia plus minusve lanceolata vel anguste elliptico-lanceolata. 11c. *S. longipes* var. *Wardii.*

Ramuli fragiles; folia in pagina superiore vulgo secundum costam sparse stomatifera . . . . . 12. *S. Harbisonii.*

SECT. I. NIGRAE Loudon. — Sect. *Australes* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. XV. 114 (1858), ex parte. — Sect. *Austro-americanae* sive sect. *Humboldtianae* Andersson in Svensk. Vetensk. Akad. Handl. VI. 15 (Mon. Salic.) (1867), ex parte. — For further information see Schneider in Bot. Gaz. LXV. 5 (1918). It may be mentioned that in a certain form of *S. nigra* which will be discussed later the upper epidermis of the leaves contains relatively few or no stomata at all.

1. **S. Humboldtiana** Willdenow. — See Schneider, l. c. 6. — As I have stated, this species in its typical form is confined to South America.

1b. **S. Humboldtiana** var. **stipulacea** (Martens & Galeotti) Schneider. — See Schneider, l. c. 7 (1918). — This variety represents the type in Central America and Mexico but does not reach the southern border of the United States.

1c. **S. Humboldtiana** var. **Martiana** (Leybold) Andersson. — See Schneider, l. c. 8 (1918). — A badly understood form which seems to be confined to certain parts of Brazil and Colombia.

2. **S. nigra** Marshall, Arbust. Am. 139 (1785). — Muhlenberg in Neue Schrift. Ges. Nat. Fr. Berlin, IV. 237, t. 6, fig. 5 (1803). — Michaux f., Hist. Arb. Am. III. 324, t. 5, fig. 1 (1813); N. Am. Sylva, III. 78, t.125, fig. 1 (1819). — Pursh, Fl. Am. Sept. III. 614 (1814). — Hooker, Fl. Bor.-Am. II. 148 (1839). — Barratt, Salic. Am. no. 20 (1840). — Carey in Gray, Man. 429 (1848). — Andersson in Svensk. Vetensk. Akad. Handl. VI. 19, t. 2, fig. 15 (Monog. Salic.) (1867), ex parte; in De Candolle, Prodr. XVI.[2] 200 (1868), ex parte. — Newhall, Trees N.E. Am. 72, fig. 36 (1890). — Bebb apud Watson & Coulter, Gray Man. ed. 6, 480 (1890), excl. var. *Wardii*. — Sargent, Silva N. Am. IX. 103, t. 462 (1896), excl. syn. ex parte; Man. Trees N. Am. 168, fig. 140 (1905), pro parte max. — Glatfelter in Trans. Acad. Sci. St. Louis, VI. 427, t. 1, figs. 5–7, 10 (1894). — Britton & Brown, Ill. Fl. I. 494, fig. 1173 (1896). — Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 118 (Nomencl. Arb. Fl.) (1897), ex parte. — Ball in Proc. Iowa Acad. Sci. VII. 143 (1900); in Elys. Mar. III. 19 (1910). — Mohr in Contrib. U.S. Nat. Herb. VI. 465 (Pl. Life Ala.) (1901). — Small, Fl. S.E. States, 341 (1903), ex parte. — Schneider, Ill. Handb. Laubh. I. 32, figs. 11a-b, 12a (1904). — Hough, Handb. Trees, 78, figs. 91–92 (1907), pro parte max. — Robinson & Fernald, Gray's Man. 320, fig. 640 (1908). — Britton & Shafer, N. Am. Trees, 183, fig. 184 (1908), ex parte et excl. syn. — Small, Shrubs Florida, 9 (1913). — Rydberg, Fl. Rocky Mts. 191 (1917). — *S. pentandra* Walter, Fl. Car. 243 (1788). — *S. flavo-virens* Hornemann, Cat. Hort. Hafn. Suppl. II. 11, ex Willdenow, Berl. Baumz. ed. 2, 426 (1811), pro syn. *S. nigrae*. — *S. ligustrina* Michaux f., Hist. Arb. Am. III. 326, t. 5, fig. 2 (1813); N. Am. Sylva, III. 80, t. 125, fig. 2 (1819). — *S. falcata* Pursh, Fl. Am. Sept. II. 614 (1814). — Hooker, Fl. Bor.-Am. II. 149 (1839). — Forbes, Salict. Woburn. 279, t. 148 (1829). — *S. Houstoniana* Pursh, Fl. Am. Sept. II, 614 (1814), ex parte. — Forbes, Salict. Woburn.

21, t. 11 (1829). — ? *S. ambigua* Pursh, Fl. Am. Sept. 617 (1814). — ? *S. Purshiana* Sprengel, Syst. v. 608, in indice (1828). — *S. nigra* var. *falcata* Torrey, Fl. N.Y. II. 209 (1843). — Carey in Gray, Man. 429 (1848). — Andersson in Ofv. Svensk. Vetensk. Akad. Förh. xv. 114 (1858). — Newhall, Trees N.E. Am. 74, fig. 37 (1890). — Sargent, Silva N. Am. IX. 104, t. 463 (1896). — *S. nigra* a. *angustifolia a. falcata* et *β. longifolia* Andersson in Svensk. Vetensk. Akad. Handl. VI. 20 (1868). — *S. nigra* b. *latifolia a. brevijulis* et *β. longijulis gracilescens* Andersson, l. c. 21 (1868). — *S. nigra* [subspec.] *S. furcipila* Gandoger, Fl. Europ. XXI. 167 (1890). — *S. nigra* [subspec.] *S. leptodes* Gandoger, l. c. — *S. nigra* [subspec.] *S. ventricosa* Gandoger, l. c.

A very well-known eastern species the range of which seems to extend along the Atlantic coast from southern New Brunswick to northern North Carolina, and westward through northwestern South Carolina and northern Georgia (from where I have not yet seen typical material) to central and eastern Alabama (probably also to northern Missouri), southern Arkansas (where var. *altissima* is the prevailing form) and from northern Louisiana to northeastern Texas (where it seems to spread in the central parts as far south as Val Verde County on the Rio Grande, although most of the material from Texas belongs to var. *Lindheimerii*). The southern borderline of the range of *S. nigra* reaches its most western point at about 100° W. L., and from there runs northward through central Oklahoma and the eastern parts of Kansas, Nebraska, and South Dakota.[1] For the northern limit of its range may be taken a line running from about the 95th degree W. L. along the north shores of Lake Superior through southern Ontario and Quebec to southern New Brunswick. *S. nigra* does not occur in the southwest or west where it is represented by *S. Gooddingii*. In the south the typical form apparently passes by many intermediates into var. *Lindheimerii* and var. *altissima*. Of peculiar interest are the forms of the southeast from Virginia to northern Florida because they show a smaller number of stomata on the upper surface of the leaves. While in the typical form as well as in var. *altissima* and var. *Lindheimerii* the number of the stomata is scarcely less on the upper than on the lower leaf-surface, these southeastern forms sometimes only have a few stomata along the midrib and even these seem to be occasionally wanting. I have not yet been able to detect other characters to separate these forms from typical *nigra* but for two reasons I think it best to enumerate them below. Firstly, they certainly need a further study, and secondly I wish to draw the special attention of all collectors to them, because the distribution of *S. nigra* in the southeast is very insufficiently known, and material of it from that

[1] According to the map given by Hough *S. nigra* inhabits almost the whole state of Kansas, the eastern half of Nebraska and South Dakota, the southeastern corner of North Dakota and nearly the whole of Minnesota except the northwestern corner. I have not yet seen material from the Dakotas and Minnesota but according to Lunell's enumeration (Am. Midl. Nat. IV. 197 [1916]) *S. nigra* is wanting in North Dakota, and according to Petersen (Fl. Nebr. ed. 2, 69 [1912]) it occurs in Nebraska only in the eastern part of the state. It is absent from northern central and western Kansas (see Hitchcock in The Industrialist, XXIV. 323 [Fl. Kansas] [1899.])

region in herbaria is very scanty. From the range given in Britton and Brown's Flora or in Small's Flora it would appear that *S. nigra* was distributed along the whole eastern coast including Florida. In his Florida Shrubs 9 (1913), Small distinguishes two species from northern Florida with " leaf-blades green beneath." One he calls *S. nigra*, and the other *S. marginata* " Weimer " [Wimmer]. The first apparently represents the form I refer to above, while *S. marginata* seems to me identical with the plant I describe as *S. Harbisonii*. As to the name *marginata* see later under *S. longipes venulosa*. Harper, in his Geogr. and Veget. of northern Florida (in Sixth Ann. Rep. Florida Geol. Surv. 401 [1914]) says under *S. nigra* " Banks of streams, etc., mostly westward." He probably too includes forms of *S. Harbisonii* which, as I shall explain later, often looks intermediate between *S. nigra* and forms of *S. longipes*. I have been able to examine the following specimens of what I believe is a form closely related to typical *S. nigra* from Virginia to northern Florida.

Virginia. Alexandria County: Arlington, May 10, 1891, *F. Blanchard* (fr.; M.; stomata in pagina foliorum superiore pauciora). Dinwiddie County: Petersburg, banks of the Appomatox River, August 22, 1908, *A. Rehder* (st.; A.). Gloucester County, without exact locality, common, September 14, 1912, *C. S. Sargent* (st.; A.; very similar to the preceding). Smyth County: about falls of Holston River, June 8, 1892, *J. K. Small* (fr.; A., M.; stomata in pag. superiore foliorum partim non visa).

South Carolina. Oconee County: Clemson College, April 23, 1906, *H. D. House* (No. 1910, m., f.; N.; forma satis typica stomatibus paucioribus). Abbeville County: Calhoun Falls, along Savannah River, May 20, 1918, *T. G. Harbison* (No. 6, fr.; A.; stomata in foliis superne non visa). Darlington County: Darlington, in low swampy ground, April 24, 1918, *T. G. Harbison* (Nos. 19, fr., st., 21, fr., 23, fr.; A.; "large shrub"; stomata non visa vel tantum pauca secundum costam).

Georgia. Rabun County: Pine Mountain, along rocky stream in mountain, April 16, 1918, *T. G. Harbison* (Nos. 1, 2, m.; A.; "small tree"; flowers very young, twigs rather brownish); Clayton, on bank of small stream, April 11, 1918, *T. G. Harbison* (Nos. 1, 2, m., f.; A.; "small tree with brittle-jointed twigs"; same as preceding). Gwinnett County: Yellow River, May 22, 1897, *H. Eggert* (fr.; M.; stomata superne sparsa). De Kalb County: on and about Stone Mountain, May 1–18, 1895, *J. K. Small* (m., f.; A., N.; stomata superne nulla vel sparsa). Richmond County: near Augusta, October 7, 1914, *C. S. Sargent* (st.; A.; stomata superne non visa); on bank of river, April 6, 1918, *T. G. Harbison* (No. 6, m.; A.; "large tree; bark rough and scaly; twigs brittle-jointed"). Randolph County: Cuthbert, in low ground along a small stream, March 29, 1918, *T. G. Harbison* (Nos. 4, f., 5, m.; A.; "a tree 60 ft. tall and a foot in diameter; bark furrowed and scaly in thick plates; twigs brittle-jointed"; stomata superne tantum ad costam sparsa).

Florida. Gadsden County: River Junction, in low ground, March 24, 1918, *T. G. Harbison* (No. 18, fr. im.; A.; "shrub 8 ft. tall; twigs brittle-jointed"; this form may be referable to *S. Harbisonii*); March 24, 1918, *T. G. Harbison* (No. 2, m.; A.; "a tree nearly a ft. in diameter and about 50 ft. tall; bark deeply furrowed and scaly"; stomata superne numerosa!). Duval County: Jacksonville, in low inundated swamp, March 19, 1918, *T. G. Harbison* (No. 2, fr.; A.; "large shrub or low straggling tree"; according to the rather long pedicels of the fruits this form may belong to *S. Harbisonii*).

The var. *falcata* cannot in my opinion even be distinguished as a good form (see Blake's statements in Rhodora, xv. 163 [1903]), and so far as I can

see it is hardly possible to separate any other forms but the two following. As to *S. ambigua* Pursh I can only say that it deserves its name until we find a type specimen.

2b. **S. nigra** var. **altissima** Sargent in Trees & Shrubs, II. 216 (1913). — ? *Salix* spec. Robin, Voy. Louisiana, III. 521 (1807). — ? *S. denudata* Rafinesque, Florul. Ludovic. 116 (1817). — As the varietal name indicates this willow becomes the tallest American Salix growing up to the height of 40 m. The type was collected near Fulton on the Red River, Hempstead County, Arkansas, May 20, 1909, by the well-known collector B. F. Bush (No. 5654, fr.; A.). Except in its size it differs from the type only in the more pubescent young shoots, leaves and especially the petioles which are almost barbate-tomentose above and on the average are comparatively longer, and in the shape of its leaves which as a whole are more acute at the base thus resembling var. *Lindheimerii*. Besides this var. *altissima* flowers a little later than the type where both grow together. I have seen specimens from Arkansas (Hempstead County), Louisiana (Caddo, Winn, Richland, Rapides, West Feliciana, New Orleans, St. Landry, Jefferson, Lafayette and Calcasieu Parishes), and from eastern Texas (Harrison, San Augustine, Polk, Walker, Harris, Houston, and Jefferson Counties) but some of the Texan forms need further study and may partly be referable to var. *Lindheimerii*. Sargent suggested that *S. marginata* Wimmer might be identical with var. *altissima*, but Wimmer's form belongs to *S. longipes venulosa*. *S. denudata* Rafinesque mentioned in the synonymy is an obscure species very badly described, but it seems to be referable to var. *altissima*.

2c. **S. nigra** var. **Lindheimerii** Schneider in Bot. Gaz. LXV. 9 (1918). — I have (l. c.) already dealt with this interesting variety which in some respects seems to form a connecting link between *S. nigra* and its southern representative, *S. Humboldtiana* (var. *stipulacea*), and I have enumerated the specimens examined from Mexico. In the United States it is found in the eastern part of central Texas and in southeastern Texas where I have seen it from the following counties: Grayson, Dallas, Tarrant, McLennan, Bell, Gillespie, Kendall, Comal, Bexar, Wilson, Calvado, Harris, Polk, Brazoria, Wharton, Matagorda, Victoria, Atascosa, Refugio; a specimen from Caddo County, Louisiana, is rather intermediate between var. *altissima* and var. *Lindheimerii*, and a sterile one from western Texas, Jeff Davis County (near Fort Davis, D. M. Andrews, No. 77; A.) belongs probably to those forms from Texas which I am unable to distinguish from typical *S. nigra*.[1] The var. *Lindheimerii* may also occur somewhere in southern Oklahoma along the Red River, and it seems to me to be connected by intermediates in the north with typical *S. nigra*, and more to the east with var. *altissima*, while in Mexico it comes very near *S. Humboldtiana* as I have previously stated.

[1] *S. nigra* Coulter in Contrib. U.S. Nat. Herb. II. 419 (1892), probably belongs partly to var. *Lindheimerii*, and his var. *Wrightii* seems also to represent a form of *S. nigra* and not the true *S. Wrightii*. A sterile specimen collected by C. R. Ball on the Bear Creek, 14 mi. northwest of Junction, Kimble County, August 25, 1909 (No. 1537; O.) has very short petioles, and looks much like typical *S. nigra*.

3. **S. Gooddingii** Ball in Bot. Gaz. XL. 376, t. 12, figs. 1–2 (1905). — *S. nigra* var. *venulosa* Bebb apud Coville in Contrib. U.S. Nat. Herb. IV. 199 (Bot. Death Valley Exped.) (1893). — *S. nigra* Greene, Man. Bot. San Francisco Bay, 299 (1894), non Marshall. — Eastwood, Handb. Trees Cal. 35 (1905), pro parte max. — Sudworth, For. Trees Pacif. Slope, 213, figs. 85–86 (1908), pro parte. — Jepson in Mem. Univ. Cal. II. 175, t. 56, figs. 1–3 (Silva Cal.) (1910), incl. var. *vallicola*. — Wooton in Bull. N. Mex. Agr. Coll. LXXXVII. 43, fig. (1913). — For further synonymy and literature see Schneider in Bot. Gaz. LXV. 12 (1918). — This species is widely spread in California from Tehama and Butte Counties in the north to the very south and to northern Lower California. Toward the east it is found in southeastern Nevada, Lincoln and Clarke Counties (where the type was collected), Arizona (except probably in the northern and northeastern part of the state), southwestern New Mexico (probably not north of Socorro County and not east of the Rio Grande), and northwestern Texas (El Paso and Jeff Davis Counties). There is a specimen in Herb. N., collected by Frémont, "on road day we left Canyon Arkansas River Aug. 28," 1845 (No. 402[a], st.) which would mean Colorado if the locality is correctly given. I have seen no other specimen of our species from that state. The eastern and northeastern limits of its range need further observation. It is clearly distinct from the eastern *S. nigra* for which it has been taken by most authors. There seem to be two forms which may be distinguished by the glabrousness or by the more or less copious pubescence of the young and the one-year-old branchlets; the more pubescent one would have to be taken for the type.

SECT. II. TRIANDRAE Dumortier. — Sect. *Australes* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. XV. 114 (1858), ex parte. — Sect. *Fragiles* Andersson, l. c. 115, ex parte, non Koch, nec Fries. — For further information see Schneider in Bot. Gaz. LXV. 13 (1918).

4. **S. amygdaloides** Andersson in Öfv. Svensk. Vetensk. Akad. Förh. XV. 114 (1858); in Proc. Am. Acad. Sci. IV. 53 (Salic. Bor.-Am. 8) (1858); in Walpers, Ann. Bot. V. 744 (1858). — Bebb in Rothrock, Wheeler's Rep. VI. Bot. 240 (1878); in Coulter, Man. Rocky Mts. Bot. 334 (1885); apud Watson & Coulter, Gray Man. ed. 6, 481 (1890). — Macoun, Cat. Can. Pl. II. 444 (1883). — Sargent, Rep. For. N. Am. 10 Cens. U.S. IX. 166 (1884), pro parte max.; Silva N. Am. IX. 111, t. 467 (1896), pro parte max.; Man. Trees N. Am. 170, fig. 142 (1905), pro parte max. — Glatfelter in Trans. Acad. Sci. St. Louis, VI. 428, t. 1, figs. 1, 3, 4, 8, 9 (1894). — Bush in State Hort. Rep. Mo. 1895, p. 360 (List Trees Mo.). — Williams in Bull. S. Dak. Agric. Coll. Exp. Sta. XLIII. 105 (1895). — Britton & Brown, Ill. Fl. I. 495, fig. 1175 (1896), pro parte max.; ed. 2, I. 593, fig. 1452 (1913), pro parte max. — Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 120 (Nomencl. Arb. Fl.) (1897), pro parte max.; For. Trees Pacif. Slope, 216, fig. 87 (1908). — Ball in Proc. Iowa Acad. Sci. VII. 144 (1900); in Coulter & Nel-

son, New Man. Rocky Mts. Bot. 129 (1909); in Bot. Gaz. LX. 397 (1915). — Rydberg in Britton, Man. 313 (1901); ed. 2, 313 (1905); in Mem. N.Y. Bot. Gard. I. 109 (Cat. Fl. Mont.) (1901); Fl. Colo. 93 (1906); Fl. Rocky Mts. 191 (1917). — Howell, Fl. N.W. Am. I. 617 (1902). — Small, Fl. S.E. States, 341 (1903). — Eastwood, Handb. Trees Cal. 37 (1905). — Piper in Contrib. U.S. Nat. Herb. XI. 212 (Fl. Wash.) (1906). — Hough, Handb. Trees, 75, fig. 86 (1907), pro parte max. — Jones, Willow Fam. 26 (1908). — Robinson & Fernald, Gray's Man. 321, fig. 642 (1908). — Britton & Shafer, N. Am. Trees, 188, fig. 146 (1908). — Daniels in Univ. Mo. Stud. Sci. Ser. II. 247 (Fl. Boulder Colo. 99) (1911). — Schaffner in Ohio Biol. Surv. I. 199 (Cat. Ohio Pl.) (1914). — J. L. Henry, Fl. S. Brit. Col. 73 (1915). — *Salix* [second species] Torrey in Nicollet, Rep. Upper Miss. Riv. App. B. 237 (Cat. Pl. Geyer, 160) (1843). — *S. nigra* ***S. amygdaloides* Andersson in Svensk. Vetensk. Akad. Handl. VI. 21 (Monog. Salic.) (1867). — *S. nigra β. amygdaloides* Andersson in De Candolle Prodr. XVI.[2] 201 (1868). — Porter & Coulter in U.S. Geol. Surv. Misc. Publ. No. 4. 128 (Syn. Fl. Colo.) (1874). — *S. Wrightii* Rydberg, Fl. Rocky Mts. 191 (1917), ex parte, non Andersson. The type of this well-known species came from South Dakota where it was collected on the banks of the Missouri at Fort Pierre during the voyage of Prince Maximilian Wied-Neuwied. I have not yet been able to examine the type, but so far as I can judge by the material from South Dakota at my disposal the form of this state is identical with that of Missouri described by Glatfelter. Its range extends from Quebec (about 73° W. L.) to central New York (Onondaga and Tompkins Counties) apparently along the southern shores of Lake Erie (absent from Pennsylvania) through northern Ohio (where it has been observed according to Schaffner as far south as Franklin County) and northern Indiana (where I have seen it from Jasper and Wells Counties) to Illinois, Missouri (where it is apparently absent from the southern part of the state), Kansas to northwestern Oklahoma and the northwestern corner of Texas, but the forms of Oklahoma and Texas approach the western ones which may not represent typical *S. amygdaloides*. Further to the west it is found in Colorado (except probably in the southwestern corner), Utah (here wanting apparently in the south) and Nevada (where, judging by the material before me, it does not seem to occur in the southern and central parts of the state). From Nevada the western borderline runs northward through central Oregon (Lake and Wasco Counties), southeastern Washington (West Klickitat to Whitman County) to southeastern British Columbia (eastern Kootenay according to J. L. Henry). From here the northern limit of its range seems to follow about the 50th parallel to the Winnipeg region, from where it turns a little to the south through southern Ontario and northern Quebec to Montreal. On the map given by Hough it is shown farther north in Alberta and to central Saskatchewan and central Manitoba, but I have seen no material from as far north. In the southeast Hough includes the whole course of the Ohio in the range of *S. amygdaloides* but it is not mentioned by Porter from Pennsylvania, and I have seen no specimens from the lower Ohio where it is

said to be " abundant " by Sargent (Man. 171). This is probably a mistake, as indicated above.

I am not sure whether the western forms really represent typical *S. amygdaloides*,[1] but there is certainly a form with puberulous or subtomentose young parts that deserves a special mention. Ball (1909) says that " a form with very narrow leaves, scarcely 1 cm. wide, is found on the high plains east of the Rocky Mountains." I am not yet sure to which form he refers, and I wish to state that the western forms need a much closer study than I have been able to devote to them. It may be that the following form ought to be regarded only as a form of a western variety, and that even within the range of typical *amygdaloides* another corresponding form may occur. I only wish to call attention to this western form in proposing the name **S. amygdaloides f. pilosiuscula**, forma nov.: a typo ut videtur tantum recedit ramulis foliisque novellis pilosiusculis (? rarius ramulis petiolis foliisque ad costam breviter subtomentosis; confer no. 902 Gooddingii); ramulis annotinis biennesque satis (ut fere in omnibus aliis speciminibus occidentalibus) flavescentibus, foliis superne stomatibus vulgo numerosioribus instructis, stipulis plus minusve acutis, amentis saepissime densioribus, fructibus magis approximatis. — I refer to f. *pilosiuscula* the following specimens:

Nevada. Washoe County: Wadsworth, alt. 1265 m., May 7, 1909, *A. A. Heller* (No. 10403, m., paratype; A., M.); sloughs between Pyramid and Winnemucca Lakes, alt. 1200 m., June 2, 1913, *P. B. Kennedy* (No. 1997, m., fr., im., G., Reno; foliis normalibus valde juvenilibus; forma in herbariis sub nomine inedito *S. washoensis* W. W. R. distributa). Churchill County: Carson Sink Region, alt. 1265 m., July 15, 1908, *P. B. Kennedy* (No. 1776, fr. type; A., M., Reno).

Utah. Davis County: Farmington, June 11, 1908, *J. Clemens* (fr. juv.; G.). Salt Lake County: Salt Lake City, alt. 1300 m., May 12, 1880, *M. E. Jones* (No. 1711, m.; A.); May 22, 1887, *M. E. Jones* (m., f.; A.); City Creek Cañon, Wasatch Mts., 1500 m., April 20, 1900. *S. G. Stokes* (m., f.; St.). Beaver County: Milford, along a bottom, June 4, 1902, *L. N. Goodding* (No. 1019, m., f.; A., M.). Washington County: Santa Clara Creek, May 20, 1902, *L. N. Goodding* (No. 902, fr. im.; M.; specimen a cl. Ball pro *S. laevigata* determinatum, sed ab hac species satis diversum et magis ad f. *pilosiusculam* accedens; forma satis incerta ramulis novellis et partim annotinis petiolis costaque foliorum superne tomentellis, amentis laxis fructibus in pedicello sparse pilosis, foliis normalibus nondum satis evolutis).

Colorado. Montrose County: Naturita, ditch bank, alt. 1620 m., May 26, 1914, *E. Payson* (No. 354, m., 355, f.; M.) ? Clear Creek County: Clear Creek Valley, May 27, 1916, *A. Eastwood* (Nos. 5390, f., 5391, m.; A.). Larimer County: without exact locality, foothills, alt. 1800 m., May 26, 1897, *C. S. Crandall* (No. 12, m., fr. juv.; M.; amentis fructiferis sublaxioribus); Fort Collins, alt. 1500 m., May 15, 1896, *C. F. Baker* (m.; M.). Weld County: Greely, June 24, 1896, *L. H. Pammel* (No. 205, fr.; M.; parcissime pilosa); Evans, 1909, *E. L. Johnson* (No. 541, m., f.; M.). Morgan County: Fort Morgan, June 23, 1896, *L. H. Pammel* (No. 206, st.; M.). Las Animas County: bank of Purgatoire River near Trinidad, 2000 m., May 13, 1892, *C. S. Crandall* (No. 9, m., f.; C.).

[1] Professor J. S. Jack collected a very vigorous form at Holland near Pullman, Wash., Aug. 31, 1918 (No. 1241, st.; A.), that looks much like vigorous forms collected by Glatfelter near St. Louis, Mo., but in the western form the stipules are decidedly acute, not rounded as in the type. The young shoots and leaves are puberulous.

IDAHO. Bear Lake County: Montpelier, creek bank, May 15, 1910, *J. F. Macbride* (No. 17, m. tantum; M.). Ada County: Boise, along the river, alt. 900 m., May 26, 1911, *J. A. Clark* (No. 21, fr. juv.; C., M., St.; forma tantum parce pilosa). Washington County: Weiser, alt. 660 m., July 5, 1899, *M. E. Jones* (No. 6545, fr.; M.). Nez Perces County: about Lewiston, alt. 240 m., June 9, 1896, *A. A. & E. G. Heller* (No. 3201, m., f.; A., St.; forma parcissime pilosa).

WASHINGTON. Whitman County: Almota, May 27, 1893, *C. V. Piper* (No. 1776, m.; C.); near Pullman, Aug. 31, 1918, *J. S. Jack* (No. 1244, st.; A.; "15 ft. high, several stems 2–3 in. diam.").

OREGON. Lake County: Alkali, May, 1882, *Th. J. Howell* (m., f.; E. M.).

There is also a puberulous form from northwestern Texas, collected by E. J. Palmer, at Canyon, along streams, Randall County, July 12, 1917 (No. 12517, st.; A.) and near Amarillo, along streams, Potter County, July 13, 1917 (No. 12538, fr.; A.); this in my opinion belongs to the typical *S. amygdaloides* while, as stated above, the f. *pilosiuscula* s. str. is a form of the western *S. amygdaloides* which can probably be regarded as a distinct variety.

In the south we find the following well-marked variety:

4b. **S. amygdaloides** var. **Wrightii** Schneider in Bot. Gaz. LXV. 14 (1918). For further synonymy and literature see Schneider, l. c.; to the quotations may be added the following given under *S. amygdaloides* pro parte minima: Sargent in 1884, 1896 and 1905; Britton & Brown in 1896 and 1913; Small in 1903 and 1913; Hough in 1908. — *S. amygdaloides* Coulter in Contrib. U.S. Nat. Herb. II. 419 (1892), non Andersson. — *S. Wrightii* Rydberg, Fl. Colo. 93 (1906); Fl. Rocky Mts. 191 (1917), pro parte. — Britton and Shafer, N. Am. Trees, 185, fig. 142 (1908), pro parte maxima. — I am not yet well enough acquainted with this variety to decide the question whether it is possible to keep it as a distinct species. Judging by the following material[1] I prefer to regard it at present as only a variety, the geographical distribution of which needs further investigation, especially in southern Colorado to where its range seems to extend. Wright's Willow seems to have also a puberulous form, but sometimes young specimens of *S. Gooddingii* are mistaken for it. Both have the same yellowish branchlets, and the very young leaves of var. *Wrightii* do not always show the glaucescent lower surface. Where the two Willows meet there may occur hybrids as it is frequently the case between *S. amygdaloides* and *S. nigra*.

WESTERN TEXAS. El Paso County: El Paso, abundant along the Rio Grande, April 1851, *G. Thurber* (No. 195, m., f.; G., N.; "large tree"); vicinity of El Paso, 1911, *E. Stearns* (No. 151, fr. im.; A.); Belen, June 19, 1893, *E. A. Mearns* (Nos. 1510, fr.; St.; 1511, fr.; A., N.). Ward County: Barstow, bank of canal, April 14, 1902, *S. M. Tracy & F. S. Earle* (Nos. 52, m., 67 f.; A.). Potter County: Amarillo Creek, along the stream, May 29, 1902, *J. Reverchon* (No. 2926, fr.; A.). Oldham County: Magenta, "S.W. Shore of lake" (1625) and Railroad gravel pit, August 26, 1910, *C. R. Ball* (Nos. 1625, 1626, 1627, st.; G., M., O.; "1 ft. diam."; Ball also collected seedlings, No. 1622, "in small sandy flat back of section house."

[1] Since this was written I have seen also the material in Herb. W. which probably contains the richest collection of Salix specimens from Texas and New Mexico. It is a matter of personal opinion whether to regard *S. Wrightii* as a species or as a variety of *S. amygdaloides*. I prefer, however, to keep it as a variety.

New Mexico. Dona Ana County: Las Cruces, Experiment Station, June 13, 1911, *C. R. Ball* (No. 1739, fr.; G., M., O.; "large tree"); Valley of the Rio Grande, near La Mesilla, June 19, 1858, *S. Hayes* (fr.; C.); at Mesilla, April, 1897, *T. D. A. Cockerell* (m., f.; N.); same locality, alt. 1150 m., June 21, 1897, *E. V. Wooton* (No. 44, fr.; G., M.; in St. forma foliis subtus concoloribus porro observanda); in the Mesilla Valley, alt. circ. 1150 m., April 19, 1907, *E. V. Wooton & P. Standley* (No. 3242, m.; C., M.). Sierra County: Tierra Blanca, 1904, *I. N. Beals* (fr.; A.). Otero County: Sacramento Mts., Fresnal Canyon, below High Rolls, alt. 1800 m., August 26, 1916, *A. Rehder* (No. 445, st.; A.).

Sect. III. Pentandrae Dumortier, subsect. Lucidae, subsect. nov. — Sect. *Fragiles* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. xv. 115 (1858), ex parte. — Sect. *Lucidae* sive sect. *Pentandrae* Andersson in Svensk. Vetensk. Akad. Handl. vi. 30 (Mon. Salic.) (1867), ex parte. — Sect. *Pentandrae* Ball in Coulter & Nelson, N. Man. Rocky Mts. Bot. 130 (1909), non Dumortier.

At present I think it best to keep the American forms which are most closely related to *S. pentandra* L. in a special subsection, although *S. serissima* may perhaps be more correctly referred to the true *Pentandrae*.

5. **S. serissima** Fernald in Rhodora, vi. 6 (Dec. 28, 1903); Robinson & Fernald, Gray's Man. 322, fig. 645 (1908). — Britton & Brown, Ill. Fl. ed. 2, i. 594, fig. 1455 (1913). — Rydberg in Britton, Man. Fl. N. St. Can. ed. 2, 1061 (1905); Fl. Rocky Mts. 191 (1917). — ? *S.* (*pentandra*) *lucida ovatifolia densiflora* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. xv. 115 (1858); in Proc. Am. Acad. iv. 54 (Salic. Bor.-Am. 8) (1858). — ? *S.* (*pentandra*) *lucida pilosa* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. xv. 115 (1858), pro parte. — ? *S.* (*pentandra*) *lucida* var. *angustifolia* f. *pilosa* Andersson in Proc. Am. Acad. iv. 54 (1858), pro parte. — ? *S. lucida angustifolia rigida* Andersson in Svensk. Vetensk. Akad. Handl. vi. 32 (Monog. Salic.) (1867), pro parte. — ? *S. arguta erythrocoma* Andersson l. c. 33. — ? *S. erythrocoma* Barratt ex Andersson l. c., pro synon. — Rydberg, Fl. Rocky Mts. 191 (1917), an tantum ex parte ? — *S. arguta* **S. pallescens* Andersson in Svensk. Vetensk. Akad. Handl., vi. 32 (1867), prob. incl. f. *hirtisquama* Andersson, l. c. 34, sed. excl. f. *alpigena* Andersson, l. c. 33. — *S. arguta* δ, *pallescens* Andersson in De Candolle, Prodr. xvi.[2] 206 (1868). — *S. lucida ovalifolia* Andersson, l. c. 205 (1868). — *S. lucida serissima* Bailey apud Arthur in Bull. Geol. Nat. Hist. Surv. Minn. iii. 19 (1887). — For further synonymy and literature see Fernald in Rhodora vi. 7 (1903). — This interesting and well-marked species has always been confused with *S. lucida* or *S. amygdaloides*, until its characteristic features were recognized by Bailey and later with more preciseness by Fernald. Unfortunately Fernald did not pay attention to the forms described by Andersson and enumerated above in the synonymy. Andersson had to deal with little and insufficient material, therefore, he was, apparently, not able to get a clear understanding of the different forms he referred to *S. lucida* and *S. arguta*. Without having seen all the material upon which Andersson based his descriptions it is impossible to elucidate his varieties and forms, but there can

hardly be any doubt that his *S. pallescens*[1] with the exception of f. *alpigena* and his *S. lucida pallescens* are the same as *S. serissima*. The type was collected by Bourgeau on the Saskatchewan and of f. *hirtisquama* by the same collector "ad lac. Winnipeg." Andersson describes the leaves as "subtus pallide glaucescentibus" and the fruits as "distinctius pedicellatis," and there is no other willow to which the name could be applied in the region from which the type came.

*S. arguta erythrocoma* Andersson or *S. erythrocoma* Barratt which is regarded by Rydberg (Fl. Rocky Mts. 191 [1917]) as a good species represents a mixture of forms from Lake Winnipeg (belonging, so far as I can judge by the specimen in Herb. G., to *S. serissima*) and from the Columbia (collected probably at the mouth of this river in April–May 1825 by Dr. Scouler). I have seen a specimen of the last named under No. 62 in Herb. N. consisting of male and female flowers. I cannot distinguish it from typical *S. lasiandra*. There is another specimen under No. 61 of Dr. Scouler from the Columbia in Herb. N. also labeled *S. erythrocoma* Barratt. It consists of very young female flowers of *S. lasiandra*, and also of a branch with male aments of which the flowers do not seem to be normal. It is too poor to be properly identified.

According to Fernald who gave an excellent account of this species it ranges "from the Housatonic Valley, Massachusetts, to the north shore of Lake Superior, south to Morris County, New Jersey, western New York, northern Ohio, Michigan, Wisconsin, and Minnesota." I have seen it also from northeastern Indiana (Steuben and La Grange Counties). In the northeast its range extends to Newfoundland (Valley of Exploit River) and Anticosti Island, whence its northern limit seems to run to the eastern shores of James Bay and to reach its northernmost point in Keewatin, on the Severn River (J. M. Macoun, No. 2028, O.), while from further west I have seen specimens from near Edmonton, Alberta. From here the western borderline runs south to Banff and Crow's Nest Lake in Alberta and then turns to the east to Sidney in Manitoba and to northeastern Minnesota (St. Louis County).

6. **S. lasiandra** Bentham, Pl. Hartweg. 335 (1857). — Torrey in Pacific R.R. Rep. IV. Bot. 138 (1857). — Sargent, Rep. For. N. Am. 10 census U.S. IX. 167 (1884), excl. var.; Silva N. Am. IX. 115, t. 469 (1896), excl. var.; Man. Trees 173, fig. 145 (1905). — Bebb in Bot. Gaz. XVI. 103 (1891). — Greene, Man. Bot. San Francisco Bay, 299 (1894). — Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 120 (Nomencl. Arb. Fl.) (1897), pro parte max. — Ball in Trans. Acad. Sci. St. Louis, IX. 71 (1899), pro parte; in Coulter and Nelson, New Man. Rocky Mts. Bot. 130 (1909). — Howell,

[1] This name cannot be used according to the Philadelphia Code because there is an earlier *S. pallescens* Schleicher (Cat. Pl. Helv ed. 3. 26. 1815) which had probably been published first in ed. 2 (1807). The International Rules would permit the use of the name because Schleicher's name is a nomen nudum and represents nothing but a form of *S. nigricans* Smith, but as it is doubtful whether Andersson's binomial can be regarded as a correct publication of a species or only of a subspecies I abstain at present from using this name.

Fl. N.W. Am. 617 (1902). — Schneider, Ill. Handb. Laubh. I. 29, figs. 11c–d. 15a, (1904), excl. var. *caudata*. — Eastwood, Handb. Trees Cal. 38 (1905). — Piper in Contrib. U.S. Nat. Herb. XI. 212 (Fl. Wash.) (1906). — Jones, Willow Fam. 27 (1908), pro parte et excl. var. — Jepson, Fl. Cal. 338 (1909); in Mem. Univ. Cal. II. 175, t. 56, figs. 1–3 (Silva Cal.) (1910). — Wooton in Bull. N. Mex. Coll. Agric. LXXXVII. 41, fig. p. 42 (1913). — Henry, Fl. S. Brit. Col. 96 (1915), excl. var. *caudata*. — Wooton & Standley in Contrib. U.S. Nat. Herb. XIX. 160 (Fl. N. Mex.) (1915). — *S. lucida* Hooker, Fl. Bor.-Am. II. 148 (1839), pro parte, non Muhlenberg. — *S. speciosa* Nuttall, N. Am. Sylva, I. 58, t. 17 (1843), and reprint 1852, probabiliter pro parte, non Host, nec Hooker et Arnott. — *S.* (*pentandra*) *lucida angustifolia lasiandra* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. XV. 115 (1858). — *S. Fendleriana* Andersson, l. c. (1858), pro parte, s. str. — Wooton & Standley in Contrib. U.S. Nat. Herb. XIX. 160 (1915), pro parte. — *S. lucida* **macrophylla* Andersson in Svensk. Vetensk. Akad. Handl. VI. 32 (Monog. Salic.) (1867); in De Candolle, Prodr. XVI.[2] 205 (1868). — *S. arguta lasiandra* Andersson in l. c. 33 (1867); l. c. 205 (1868). — *S. arguta erythrocoma* Andersson, l. c. 33 (1867), pro parte; l. c. 205 (1868), pro parte. — *S. lasiandra* var. *typica* Bebb in Watson, Fl. Cal. II. 84 (1879). — Macoun, Cat. Can. Pl. I. 449 (1883); II. 358 (1890). — *S. lasiandra* var. *Lyallii* Sargent in Gard. & For. VIII. 463 (1895); Silva N. Am. IX. 115, t. 470 (1896). — Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 120 (Nomencl. Arb. Fl.) (1897); For. Trees Pac. Slope 219, figs. 89–90 (1908). — Ball in Piper & Beattie, Fl. N.W. Coast, 114 (1915). — *S. Lyallii* Heller in Bull. Torr. Bot. Club, XXV. 580 (1898), ut videtur pro parte tantum. — Britton & Shafer, N. Am. Trees, 191, fig. 149 (1908). — Rydberg, Fl. Rocky Mts. 191 (1917), ex parte.

The history of this species of which its first describer Nuttall said that " no Willow of the American continent presents so remarkable and splendid an appearance " has been already discussed at a considerable length by Ball (1899). He explained the reason why the typical form has been so often misunderstood, and so many varieties have been described which in fact represent nothing but the type. According to Ball (1899) Andersson's *S. Fendleriana* is a synonym of *S. lasiandra caudata*, and the name has to be applied to this variety if we take it for a species. But in this respect I differ from Ball for the following reasons. Andersson based his *S. Fendleriana* on Fendler's No. 816 which came from New Mexico and was collected " probably about Santa Fe " (fide Wooton and Standley), and Andersson besides mentions Geyer's No. 287 from the Rocky Mountains. Only the last specimen belongs to var. *caudata* while No. 816, in my opinion, represents the typical *S. lasiandra* or at least a form of it which is different from var. *caudata*. Therefore, the name *S. Fendleriana* cannot be used for that species if we regard var. *caudata* as specifically distinct.

To the typical *S. lasiandra* also belongs Andersson's *S. lucida macrophylla* of which I have seen a photograph and fragments of the type in Herb. K. and a co-type in Herb. G. It was collected by Dr. Lyall in May

1859 at Sumas Prairie "Lower Frazer River 49. N. Lat." according to the label in Herb. K. The printed labels of both herbaria bear the inscription: "*Salix lucida tenuior* (*S. pentandra americana* Andr.)" Andersson probably later changed the name *tenuior* to *macrophylla*. Lyall's specimens show a large dorsal gland in the male flowers, and a similar gland may be observed in the flowers of other male specimens from British Columbia which otherwise are apparently not distinguishable from typical *S. lasiandra*. Further observation of more copious material must prove if this character is of any taxonomic importance; in this case we could distinguish this northern glabrous form as a special variety using the name *macrophylla*. Sargent founded his var. *Lyallii* upon Lyall's specimens in changing the older name *macrophylla*, and Heller raised var. *Lyallii* to specific rank, a fact already rightly deplored by Ball (1899). In 1915, however, Ball applied the name var. *Lyallii* to a form of *S. lasiandra* common within the area of Piper and Beattie's Flora of the Northwest Coast. I am not aware of the reason for which Ball has been induced to do this, but in my opinion, even if it should be possible to distinguish the northern glabrous form from the typical *S. lasiandra* of California the name var. *Lyallii* cannot be used.

In 1867 Andersson created two new species: *S. arguta* and *S. lancifolia*. To *S. arguta* he referred his *S. Fendleriana* of 1858 as a synonym but only "p. p." Nevertheless he cited both specimens upon which he previously based this species, and added to them in the first place a specimen collected by Bourgeau "ad fl. Saskatchavan, prope Carlton-house." This specimen (I have not yet seen the type in Herb. K.) probably belongs to *S. lucida* and is identical with one of Bourgeau's specimens from the "Saskatchevan, 1859," preserved in Herb. G. Therefore the typical *S. arguta* of Andersson consists of 3 different things, namely *S. lucida* (Bourgeau), *S. lasiandra* (Fendler's No. 816, as explained before), and *S. lasiandra caudata* ("Burke et Geyer No. 287"). Andersson himself said of *S. arguta* (1867): "Valde dubius sum, utrum a *S. lucida* distincta an cum ea conjugenda sit," and he was not sure whether it might be "quasi hybrida a *S. lucida* et *S. cordata*" (1868). In spite of all his doubts he adds (1867) the var. *lasiandra* which is nothing but the typical *S. lasiandra*, and var. *erythrocoma*. Under the name *S. erythrocoma* Barratt had distributed as No. 40 Herb. H. & T. a *Salix* "common on the Islands and shores of Lake Winnipeg" of which I have seen a male specimen in Herb. G. It seems to belong to *S. serissima*, but Rydberg (Fl. Rocky Mts. 191 [1917]) has taken up Barratt's name for a species which he places next to *S. serissima*, and which is found from Manitoba to British Columbia and the Mackenzie River valley. I have seen no material from these regions which I could identify with Rydberg's *S. erythrocoma*. Andersson had named his var. *erythrocoma* in 1858 *S.* (*pentandra*) *lucida pilosa*, and in both places he cites, besides the Winnipeg material, "Columbia River" and "Fort Franklin," mixing, apparently, forms of different affinity as I have already explained under *S. serissima*.

The second species created by Andersson in 1867, is *S. lancifolia* of which

the type was collected by Dr. Lyall " in insula Vancouver." Of this species a photograph and fragments of the type and a co-type from Herb. G. are before me. It represents, in my opinion, only a form of *S. lasiandra* with " ramulis puberulis," and if we keep it as a variety as Bebb did we have to include the hairy forms of California. It may be that we can separate the typical southern *lasiandra* from the northern variety, and that both varieties produce a hairy form, in which case the southern form should have a new name. I have tried to distinguish these two varieties by the difference in the length of the pedicels which seem to be usually shorter in the southern type, and by other characters, but as far as I can see there is hardly a character sufficiently constant to be found. Even the typical *S. lasiandra* often shows a partly rusty pubescence on the very young shoots and leaves, but some very tomentose specimens of the pubescent form from California look rather different. On the other hand we find on specimens from the Columbia in Oregon to the Yukon Territory all degrees of glabrousness to a well-marked tomentum on the shoots or on one-year-old branchlets, the presence of rufous hairs on the young leaves being sometimes rather conspicuous, while on other material the pubescence is entirely grayish. We need a series of well-collected specimens from each region to decide the taxonomic value of the different characters.

The typical *S. lasiandra* is found from southern California to the Columbia in Oregon, in New Mexico near Santa Fé (in a form which I have mentioned above) and in certain forms in southwestern Colorado (Montezuma, San Miguel and Gunnison Counties) which hitherto have been partly mistaken for *S. amygdaloides* and *S. laevigata*. In Nevada and Sierra Counties of California and in western Nevada it seems to grow together with var. *caudata*, and there are certain specimens before me which I am actually at a loss to refer to either variety. Towards the north *S. lasiandra* (in its glabrous form which as I said may possibly be separated under the varietal name *macrophylla*) occurs from Oregon (where I have seen it from the following counties: Josephine, Douglas, Marion, Multnomah, Wasco, Columbia), Washington (counties: W. Klickitat, Pierce, King, Chehalis, Clallam) to British Columbia (coast region, but also in Kootenay), and it has been collected in northwestern Alberta (Peace River Landing, J. M. Macoun, No. 21266; O.) and in the Yukon Territory (vicinity of Dawson). The hairy form may be separated at present as

6b. **S. lasiandra** var. **lancifolia** Bebb in Watson, Bot. Cal. II. 84 (1879), probabiliter tantum ex parte. — Macoun, Cat. Can. Pl. I. 450 (1883), pro parte; II. 358 (1890). — *S. lancifolia* Andersson in Svensk. Vetensk. Akad. Handl. VI. 34, t. 2, fig. 23 (Monog. Salic.) (1867); in De Candolle, Prodr. XVI.[2] 206 (1868). — A typo praecipue differt ramulis hornotinis dense saepius etiam annotinis biennilusque plus minusve vel partim pubescentia villosa grisea vel fusca vestitis, foliis initio (saltem parvis ad basim pedunculorum) subtus plus minusve distincte ferrugineo-sericeis.

In Andersson's type the pedicels of the fruits are somewhat pilose and measure from 1 to 1.5 mm. I refer to this variety the following specimens:

YUKON TERRITORY. Vicinity of Dawson, May 29, 1914, *A. Eastwood* (No. 113, f.; A.); June 29, 1914, *A. Eastwood* (No. 304, fr. im.; A.); June 30, 1914, *A. Eastwood* (No. 466, fr.; A.).

BRITISH COLUMBIA. Vancouver Island, 1858, *D. Lyall* (fr. type; K.); district of Renfrew, common along streams, August 7, 1902, *C. O. Rosendahl* (No. 900 [=60283, O.], fr.; "4-10 m."); Victoria, in a field, July 23, 1887, *J. M. Macoun* (No. 24557, O., fr.); Cedar Hill, near Victoria, May, 1885, *Fletcher* (No. 24556, O., m., f.); New Westminster district, Chilliwack Lake, July 11, 1906, *W. Spreadborough* (No. 79555, O., fr.); New Westminster Junction, April 29, 1889, *J. M. Macoun* (No. 24553, O., f.); Agassiz, damp places, May 20, 1889, *J. M. Macoun* (No. 24552, O., m.); Kootenay district, Revelstoke, swamps, May 3 and 25, 1890, *J. M. Macoun* (No. 11 [=24554, O.], n., f.); Deer Park, Lower Arrow Lake, June 10, 1890, *J. M. Macoun* (No. 24559, O., fr.).

WASHINGTON. Chehalis County: Gray's Harbor, May 13, 1897, *F. H. Lamb* (No. 1033, fr.; M.; amentis ad 9 cm. longis); Hoquiam, May 13, 1897, *F. H. Lamb* (No. 1032, m.; M.); Quiniault, at edge of lake, flooded at high water, June 25, 1902, *H. S. Conard* (No. 160, st.; G.; "20 ft. high"). Pierce County: Cascade Mts., upper valley of the Nisqually River, on banks of streams and in swamps, *O. D. Allen* (No. 109, f., fr.; A., M.; "tree 25 ft. high"). King County: Lake Union, June 25, July 12, 1898, *T. E. Savage, J. E. Cameron* and *F. E. Lenocker* (fr.; M.; distributed sub nom. *S. cordata*). West Klickitat County: Columbia River, bottom lands, April 23, May, 1881, *W. N. Suksdorf* (m., f., fr.; A.); April, 1882, same coll. (m.; G.; ex Herb. Bebb).

OREGON. Douglas County: on the upper Umpqua River, August 17, 1880, *G. Engelmann* (fr.; M.); Calapooya Valley, woods near river, alt. 240 m., July 25, 1899, *M. A. Barber* (No. 101, fr.; G.). Marion County: Salem, low ground, along Mill Creek, at Center St. Bridge, April 12, July 13, 1918, *J. C. Nelson* (Nos. 2033, m., 2377, st.; A.; forma parce pilosa). Multnomah County: without exact locality, June, 1880, *J. Howell* (m., f.; G.); Sauvie's Island, April, 1879, *J.* and *Th. Howell* (m., f.; M.); same place, June, 1882, *Th. Howell* (m., fr.; M.).

CALIFORNIA. San Bernardino County: San Bernardino, January, 1881, *S. B.* and *W. F. Parish* (No. 546 partim, m.; A.); March, 1882, same coll. (No. 546 partim, m., f.; M.; this specimen shows a much less dense pubescence than the preceding one); March 19, 1894, *C. S. Sargent* (m.; A.; ut praecedens); same place, 1882, *C. C. Parry* (No. 303, n.; M.; agrees with the first No. 546); January 12, 1881, *W. S. Wright* (Nos. 23, 24, 25, m.; C.; ut praecedens, folia anni praeteriti partim persistentia); without locality, 1882, *C. C. Parry* (No. 304, fr.; M.; only young shoots thinly pubescent); Fawnokin (?) Park, alt. 2100 m., June 3, 1901, *S. B. Parish* (No. 4996, st.; St.; ut praecedens). Los Angeles County: Pasadena, March 7, 1882, *M. L. Jones* (No. 3042, m., f.; A.); Los Angeles, 1881, *J. C. Nevin* (No. 472, m., fr.; G.); river bottom, April 2, 1893, *A. J. McClatchie* (m., f.; N.). Santa Cruz County: Santa Cruz, March, 1894, *C. L. Anderson* (f.; A.). Tulare County: Kern Lake, Kern River, by river above falls, July 19, 1897, *W. R. Dudley* (No. 2028, f.; St.; ramuli tantum hornotini tomentelli); General Grant Park, meadow near Soldier's Camp, August, 1900, *W. R. Dudley* (No. 3095, fr.; St.; ut praecedens); same Park, meadow east of Dorst Creek, August 5, 1900, *W. R. Dudley* (No. 3058, st.; St.; ut No. 2028); Marble Fork at crossing of Colony Mill Trail, August 17, 1900, *W. R. Dudley* (No. 3039, fr.; St.; quam praecedentes glabrior).

I have seen from Tulare County in Herb. St. some specimens collected by Dudley (Nos. 1492[a], 1848, 2079, 2088, 3218) which seem to represent a forma foliis parvis anguste lanceolatis et breviter petiolatis quasi simulans var. *caudatam*. These specimens need further observation. Another small and narrow-leaved form of which the leaves are distinctly glaucous beneath

was collected by W. L. Jepson, Napa River Basin, Howell Mt., May 8, 1893 (No. 29s, fr. juv.; Jeps.; folia semi-evoluta ad 6:1 cm. magna).

6c. **S. lasiandra** var. **caudata** Sudworth in Bull. Torr. Bot. Club, xx. 43 (1893); in Bull. U.S. Dept. Agric. Div. For. xiv. 121 (Nomencl. Arb. Fl.) (1897), pro parte max. — Bebb[1] in Gard. & For. viii. 372 (1895), ex parte. — Sargent, Silva N. Am. ix. 116, t. 470 (1896); Man. Trees N. Am. 174 (1905), pro parte. — Ball in Trans. Acad. Sci. St. Louis, ix. 74 (1899), pro parte max. — Schneider in Ill. Handb. Laubh. i. 29, figs. 15b–c, 1904. — Piper in Contrib. U.S. Nat. Herb. xi. 213 (Fl. Wash.) (1906), pro parte max. — Piper & Beattie, Fl. S.E. Wash. 73 (1914). — Henry, Fl. S. Brit. Col. 96 (1915). — *S. pentandra caudata* Nuttall, N. Am. Sylva i. 61, t. 18 (1843). — *S. Fendleriana* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. xv. 115 (1858), pro parte, quoad spec. Geyeri No. 287. — Howell, Fl. N.W. Am. i. 617 (1902), pro parte max. — Rydberg, Fl. Colo. 94 (1906), pro parte max.; Fl. Rocky Mts. 191 (1917), pro parte max. — Ball in Coulter & Nelson, New Man. Rocky Mts. Bot. 130 (1909), pro parte max.; in Bot. Gaz. lx. 397 (1915). — Visher in Muhlenb. ix. 71 (Add. Fl. S. Dak.) (1913). — Wooton & Standley in Contrib. U.S. Nat. Herb. xix. 213 (1915), pro parte. — *S. arguta* Andersson in Svensk. Vetensk. Akad. Handl. vi. 32, t. 2, fig. 22 (Monog. Salic.) (1867), pro parte et excl. var.; in De Candolle, Prodr. xvi.[2] 206 (1868), pro parte et excl. var. $\beta$, $\gamma$, $\delta$. — ? *S. arguta* **S. pallescens alpigena* Andersson in Svensk. Vetensk. Akad. Handl. vi. 33 (Monog. Salic.) (1867). — ? *S. arguta* $\theta$ *alpigena* Andersson in De Candolle, Prodr. xvi.[2] 206 (1868). — *S. lasiandra* var. *Fendleriana* Bebb apud Watson Bot. Cal. ii. 84 (1879), pro parte max.; in Coulter, Man. Rocky Mts. Bot. 334 (1885), pro parte max. — Sargent, Rep. For. N. Am. 167 (1884). — *S. lucida* var. *lanceolata* Hooker ex Bebb in Gard. & For. viii. 373 (1895), pro synon. — *S. lasiandra* Rydberg in Mem. N.Y. Bot. Gard. i. 110 (Cat. Fl. Mont.) (1900), non Bentham. — Britton & Shafer, N. Am. Trees 190, fig. 148 (1908), pro parte max. — *S. caudata* Heller in Muhlenb. ii. 186 (1906). — Daniels in Univ. Mo. Stud. Sci. Ser. ii. 247 (Fl. Bould., Colo. 99.) (1911).

In its typical form this variety is well marked, and its history has already been discussed by Ball (1899). As I have previously stated Ball included Andersson's *S. Fendleriana* which, however, sensu stricto belongs to typical *S. lasiandra* or to a new form of it. Britton and Shafer have applied the name *S. lasiandra* Bentham to var. *caudata* and taken up the name *S. Lyallii* for the true *S. lasiandra*. The distribution of var. *caudata* according to the material I have been able to examine is as follows: From northern New Mexico (Rio Arriba County, fide Wooton and Standley) the eastern

[1] According to Bebb the oldest name for this variety is *S. lucida* var. *lanceolata* said to have been used by Hooker, Fl. Bor.-Am. ii. 148 (1839), but Hooker did not make such a variety, he only mentions a *S. lucida* "$\beta$ foliis lanceolatis" without indicating which of the specimens enumerated by him represents this form. Bebb stated that the type of Hooker's variety "is no. 39 of the Hooker, Barratt and Torrey distribution" in the Kew Herbarium. I have not yet seen this specimen which was collected by Drummond in the Rockies at Jasper Lake, and I believe it does not belong to var. *caudata* but to *S. lucida*.

borderline runs northward through eastern Colorado (where it seems not to cross the 103rd degree W. L.), Wyoming and Lawrence and Harding Counties in western South Dakota (Black Hills, fide Ball [1] and Visher) to Montana (where it seems to be present only in the south and west; I have seen specimens from Carbon, Gallatin, Jefferson, Powell, Sanders and Flat Head Counties). In the north I know var. *caudata* from eastern Kootenay (Farnie) in British Columbia, and from Calgary in Alberta. The western borderline [2] runs from Yale district in British Columbia southward through Washington (east of the Cascades), Oregon (Umatilla, Wallowa, Union, Morrow, Malheur and Klamath Counties) to Nevada (Washoe, Ormsby, Elko, Lincoln Counties) and part of the northeastern slopes of the Sierra Nevada in California (viz., A. Eastwood, No. 386, Placer County, Deer Park, Heller, No. 12720, Yuba River below Cisco and several specimens of Dudley's from Sierra County). In the south I have seen it from Utah (southward to Piute and Washington Counties) but not from Arizona. The typical form of var. *caudata*, according to Nuttall, is that with "ramulis junioribus hirsutis," and as it is the case with other species of this group we can also distinguish a glabrous form. I should regard var. *caudata* as a good species were it not for a series of forms which look rather intermediate between it and typical *S. lasiandra*. It may be that these intermediates might be regarded as hybrids but at present I think it best to defer a more decisive statement until I have been able to become better acquainted with certain forms of eastern California, western Nevada, southwestern Colorado, eastern Oregon and western Idaho. Very interesting are the specimens from Tulare County, California, mentioned on p. 18 which look more like var. *caudata* than typical *S. lasiandra*. It may be that these forms with small and narrow leaves together with similar ones from Sierra, Nevada, Placer and Eldorado Counties represent a new variety which is most closely related to var. *caudata* but possesses the same glaucescent lower leaf-surface as the typical *S. lasiandra*.

7. **S. lucida** Muhlenberg in Neue Schr. Ges. Naturf. Fr. Berlin, IV. 239, t. 6, fig. 7 (1803); in Konig & Sims, Ann. Bot. II. 66, t. 5, fig. 7 (1806). — Michaux f., Hist. Arb. Am. III. 327, t. 5, fig. 3 (1813); N. Am. Sylva III. 81, t. 125, fig. 3 (1819). — Pursh, Fl. Am. Sept. II. 615 (1814). — Hooker, Fl. Bor.-Am. II. 148 (1839), pro parte, et prob. incl. var. β. — Barratt, Salic. Am. No. 17 (1840). — Torrey, Fl. N.Y. II. 208, t. 119 (1843). — Carey in Gray, Man. 417 (1848); ed. 2, 417 (1856); ed. 3, 417 (1862); ed. 4,

[1] I have seen the specimens cited by Ball from Rochford, (*F. Murdock, Jr.*, No. 4375, st.; C.) and the Deadwood plant has been collected by Ball himself. On the other hand neither he nor Visher mentions *S. lucida* from this region, but there is a specimen before me collected by W. P. Carr, Deadwood, creek banks, July 10.13 (No. 44, st.; M.) which undoubtedly is *S. lucida*, as determined by Rydberg. In Herb. C. (sheet No. 385835) there is a sterile specimen of Visher's No. 112 from Little Missouri River, July 23, 1910, named *S. Fendleriana* which belongs to an entirely different section.

[2] Ball (1909) gives the range as "New Mexico to Canada and west to the coast" but he does not mention var. *caudata* (1915) in Piper & Beattie, Fl. N.W. Coast. So far as I know it is absent from the coast region.

417 (1863). — Andersson in Svensk. Vetensk. Akad. Handl. VI. 30, t. 2, fig. 21 (Monog. Salic.) (1867), excl. f. *angustifolia* et var. *macrophylla;* in De Candolle, Prodr. XVI.[2] 205 (1868), ut in 1867. — Macoun, Cat. Can. Pl. I. 450 (1883), pro parte max. — Newhall, Trees N.E. Am. 76, fig. 38 (1890). — Bebb apud Watson & Coulter, Gray Man. ed. 6, 481 (1890). — Britton & Brown, Ill. Fl. I. 495, fig. 1176 (1896); ed. 2, I. 593, fig. 1454 (1913). — Sargent, Silva N. Am. IX. 121, t. 473 (1896), excl. syn. ex parte; Man. Trees 174, fig. 146 (1905). — Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 121 (Nomencl. Arb. Fl.) (1897), excl. syn. ex parte. — Ball in Proc. Iowa Acad. Sci. VII. 145 (1900). — Rydberg in Britton, Man. 313 (1901); Fl. Rocky Mts. 191 (1917). — Fernald in Rhodora, VI. 1 (1903). — Schneider, Ill. Handb. Laubh. I. 29, figs. 12k–k[1], 13 (1904). — Hough, Handb. Trees, 81, figs. 93–94 (1907). — Jones, Willow Fam. 27 (1908). — Robinson & Fernald, Gray's Man. 321, fig. 644 (1908). — Britton & Shafer, N. Am. Trees, 189, fig. 147 (1908). — Small & Carter, Fl. Lancaster Co., Pa., 92 (1913). — Illick in Bull. Dept. For. Pa. XI. 91, t. 29 (Penn. Trees) (1914). — *S.* (*pentandra*) *lucida* Andersson in Öfv. Svensk. Vetensk. Akad. Förh. XV. 115 (1858), quoad var. *latifoliam* et *ovatifoliam* pro parte. — The Shining Willow is as Fernald (1903) rightly observed " one of the handsomest and easiest recognized " not only of the New England but of all the American willows. Nevertheless it seems to have been often confused with *S. amygdaloides*, *S. lasiandra* and *S. serissima*, as the limits of its range as outlined on Hough's map (1907) and given by other authors are not borne out by the material I have been able to see and by a careful examination of the statements of different authors. If we commence in the northeast we find as the northeasternmost point of its geographical distribution the valleys of the Exploits and Gander Rivers in Newfoundland. From here the eastern borderline runs south through Nova Scotia to northern New Jersey (Essex and Passaic Counties) and northern Delaware (New Castle County, fide Keller & Brown, Handb. Fl. Philadelphia, 116 [1905]), where it turns to the west along the southern border of Pennsylvania (I do not know of its presence in Maryland and West Virginia or northern Kentucky which regions are included in its range on Hough's map) through central Ohio and the more northern parts of Indiana and Illinois, appearing in Iowa only in Fayette and Chickasaw Counties (see Ball, 1900), and so far as I can ascertain being absent from northern Missouri, northeastern Kansas and Nebraska (where it is indicated by Hough). From South Dakota I know the species only from a specimen collected in the Black Hills (see note on p. 20), and it is not mentioned by Saunders (in Bull. Exper. Sta. S. Dak. LXIV. 132 [1899]), while from North Dakota I have seen nothing but a specimen of Lunell's from the Turtle Mts. in Rolette County, and Lunell (in Am. Midl. Nat. IV. 298 [1916]) mentions no other locality but Willow Creek near Dumseith which is in the same county. Therefore I do not understand why Hough includes not only the whole of South and North Dakota but also the northeast corner of Wyoming and the eastern third of Montana in the *lucida* range. There is likewise no proof that it occurs in Manitoba, Assiniboia,

Saskatchewan, northeastern Alberta, Athabasca and the Northwest Territories as far north as Great Bear Lake. Apparently *S. serissima* and *S. lasiandra* have been taken for *S. lucida* of which the northeasternmost locality from where I have seen material is the Hill (or Hayes) River in Manitoba (R. Bell, August, 1880, No. 24585, fr.; O.). But it seems very rare (or represented by *S. serissima*) in these regions and in western Ontario, becoming frequent to the east of Lake Huron in southeastern Ontario and southern Quebec.

As Fernald has pointed out the typical *S. lucida* in the northeastern part of its range is frequently represented by var. *intonsa* Fernald in Rhodora VI. 2 (1903) (*S. lucida* var. *macrophylla* Fernald apud Williams in Rhodora III. 277 (1901), non Andersson) which chiefly differs by the characters indicated in the key, p. 3. In this region occurs besides var. *intonsa* a narrow-leaved form to which the name f. *angustifolia* Andersson has been applied. Andersson published this name in 1858 (in Öfv. Svensk. Vetensk. Akad. Förh. XV. 115) as " *S.* (*pentandra*) *lucida angustifolia*, foliis acuminatis, non cuspidatis," and he did not cite a type but he added as a subforma " — *lasiandra* Bth." In Proc. Am. Acad. Sci. IV. 54 (Salic. Bor.-Am. 8) (1858), the arrangement differs in so far that we read " var. *angustifolia*. — Forma *lasiandra* (*S. lasiandra*, Benth. . . . ) " and there is added a " Forma *pilosa*" which in Öfv. Svensk. Vetensk. Akad. Förh. XV. 115 (1858) was kept as a variety of the same taxonomic value as *angustifolia*. This f. *pilosa* has nothing to do with the narrow leaved form in question (see p. 16). In 1867 (in Svensk. Vetensk. Akad. Handl. VI. 32 [Monog. Salic.]) Andersson again kept a variety *angustifolia* but here he made the two forms *rigida* and *tenuis*. What he called *rigida* apparently belongs to *S. serissima* (see p. 13), while f. *tenuis* can hardly be correctly interpreted without type material. Much clearer is Andersson's statement in 1868 (in De Candolle Prodr. XVI.[2] 205) where he says under *S. lucida* " 3° *angustifolia* foliis anguste lanceolatis, basi subattenuatis, apice vulgo longius attenuatis. Locis alpestribus." We may apply this name to the narrow-leaved northeastern form, but in many respects it would be better to propose a new name for it because the application of Andersson's name is far from clear. Such a f. *angustifolia* occurs in the typical *S. lucida* as well as in var. *intonsa*, judging by the material before me. Its obtuser leaves often resemble those of a young plant or of a seedling of the type, while the normal upper leaves may be described as: e basi obtuse cuneata lanceolata, plus minusve sensim longe caudato-acuminata, ad 5:1–10: 1.5 cm. magna.

SECT. IV. BONPLANDIANAE Schneider. See Bot. Gaz. LXV. 15 (1918). — *S. Harbisonii* with brittle-jointed branchlets needs further investigation and is referred to this section only provisionally.

8. **S. jaliscana** Jones. — See key, p. 4 and Schneider in Bot. Gaz. LXV. 16 (1918).

9. **S. Bonplandiana** Kunth. — See key, p. 4 and Schneider, l. c. 17.

9b. **S. Bonplandiana** var. **pallida** Andersson. — See key, p. 4 and Schneider, l. c. 19.

9c. **S. Bonplandiana** var. **Toumeyi** Schneider, l. c. 20. — *S. Bonplandiana* Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 121 (Nomencl. Arb. Fl.) (1897), ex parte, non Kunth. — See key, p. 4. — This willow is often described as "evergreen" but this is not true. It only sometimes keeps part of its leaves until spring, a peculiarity that may be observed in other species, for instance in *S. lasiolepis* in southern California. So far as I know there is no willow that could be called evergreen.

10. **S. laevigata** Bebb in Am. Nat. VIII. 202 (1874); in Watson, Bot. Cal. II. 83 (1879); in Bot. Gaz. XVI. 103 (1891); apud Coville in Contrib. U.S. Nat. Herb. IV. 198 (Bot. Death Valley Exp.) (1892). — Sargent, Rep. For. N. Am. 10 Cens. U.S. IX. 167 (1884); Silva N. Am. IX. 113, t. 468 (1896); Man. Trees N. Am. 171, fig. 143 (1905). — Greene, Man. Bot. San Francisco Bay, 299 (1894). — Parish in Zoë, IV. 347 (1894). — Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 120 (Nomencl. Arb. Fl.) (1897), incl. var.; For. Trees Pacif. Slope, 217, fig. 88 (1908). — Ball in Trans. Acad. Sci. St. Louis, IX. 70 (1899). — Jepson, Fl. W. Mid. Cal. 136 (1901); Fl. Cal. I. 339 (1909); in Mem. Univ. Cal. II. 176, t. 56, figs. 4–6 (Silva Cal.) (1910). — Abrams, Fl. Los Angeles, 100 (1904); suppl. ed., 100 (1911). — Eastwood, Handb. Trees Cal. 37 (1905). — Jones, Willow Fam. 26 (1908). — Britton & Shafer, Trees N. Am. 187, fig. 144 (1908). — Rydberg, Fl. Rocky Mts. 191 (1917). — Schneider in Bot. Gaz. LXV. 21 (1918). — *S. laevigata angustifolia?* Bebb apud Rothrock in Wheeler Rep. VI. Bot. 374 (1878); in Watson, Fl. Cal. II. 83 (1879). — *S. laevigata* var. *congesta* Bebb, l. c. (1879). — Ball in Trans. Acad. Sci. St. Louis, IX. 71 (1899).

A well-marked species obviously the western counterpart of the eastern *S. longipes*, and closely related to *S. Bonplandiana*. The typical glabrous *S. laevigata* corresponds to *S. longipes Wardii* while the pubescent type of *S. longipes* is analogous to *f. araquipa* of *S. laevigata*. Here, as in the sections previously dealt with, each species seems to develop a pubescent and glabrous form or variety which usually seem to be connected by intermediates. I have tried to indicate the main differences between the species and varieties of this section in the key. Ball (1899) regarded *S. lasiandra* and *S. nigra* as the nearest relatives of *S. laevigata* but apparently he was not, at that time, acquainted with *S. longipes* and *S. Bonplandiana*.

I have seen *S. laevigata* from almost every county in California. In Nevada I have seen it only from Lincoln County (Goodding's Nos. 608 and 636), and it occurs probably also in Ormsby and Washoe Counties, but all I have seen from those parts of the state are rather uncertain forms of partly hybrid origin. The easternmost point of its distribution is in Arizona (Mohave and Yavapai Counties). Rydberg (1917) mentions it also from Oregon and Utah, and I believe it is to be found in southern Oregon and southwestern Utah but I have not yet seen material from those states.

Bebb distinguished two varieties: *angustifolia* and *congesta*. For var. *angustifolia* which he himself calls an "ambiguous variety" he cites as type a specimen of E. L. Greene from Yreka, Cal., which is No. 795, May 18, June 30, August 31 (m., f., fr., st.; C., sheet Nos. 4343 and 4344). I fail to find a good character by which to distinguish it from normal *laevigata* of which, of course, narrow-leaved forms occur, but the type of var. *angustifolia* is in no way "approaching *S. nigra*" as Bebb stated. For var. *congesta* Bebb did not cite a type, but merely said: "Aments short, densely flowered, scarcely exceeding the ample leaves of the peduncle: capsules globose-conical, shortly pedicelled." In Herb. C. (sheet No. 3515) and G. I found Bolander's No. 4632, from New Castle, Placer County, April, 1865, determined by Bebb himself (1877) as var. *congesta*, but I am unable to distinguish this specimen from typical *laevigata;* Ball (1899) referred to var. *congesta* Howell's No. 1393, Kellogg and Harford's No. 925 and Palmer's No. 362. The last I regard as belonging to f. *araquipa*, while No. 925 (Herb. N.) is rather doubtful and looks to me more like a form of *S. lasiandra* with stunted aments. Howell (Fl. N.W. Am. 617 [1902]) has made *S. congesta* a species occurring "along rivulets near the Klamath River and southward," and in his herbarium at Eugene, Oregon, his No. 1393 is designated as the type. It came from Hornbrook, Siskiyou County, northern California, Klamath River region. The material is young, the leaves are not yet sufficiently matured, and they possess some stomata in the upper surface. It looks much like *araquipa*, but needs further observation. Bebb's varieties do not seem to possess any taxonomic value. There is however the pubescent form f. *araquipa* Jepson (Fl. Cal. 339 [1909]. — ? *S. occidentalis* Eastwood, Handb. Trees Cal. 36 [1905], pro parte) within the range of the species, and it apparently prevails in the southern and southwestern parts of the state. The main difference from the type is in the more or less tomentose branchlets of the first and partly also of the second season, and there is hardly another character by which it may be distinguished, for it seems to be connected with the type by many intermediates.

11. **S. longipes** Shuttleworth apud Andersson in Öfv. Svensk. Vetensk. Akad. Förh. XV. 114 (1858). — Glatfelter in Rep. Mo. Bot. Gard. IX. 43, t. 5, fig. 1, t. 6, fig. 1 (Note on *S. longipes*, 1) (1897), pro parte. — Small, Fl. S.E. States, 341 (1903). — Sargent, Man. Trees N. Am. 169, fig. 141 (1905), pro parte. — Hough, Handb. Trees 76 (1907), pro parte. — Britton & Shafer, N. Am. Trees, 186 (1908), pro parte. — *S. occidentalis* Sudworth in Bull. U.S. Dept. Agric. Div. For. XIV. 119 (Nomencl. Arb. Fl.) (1897), non Bosc. — *S. occidentalis longipes* Sudw., l. c., excl. synon., pro parte. — For further synonymy and literature see Schneider in Bot. Gaz. LXV. 21 (1918).

From the synonymy which I (1918) have given, it may be seen that this species was described first by Bosc apud Koch (1828), as *S. occidentalis*, from specimens collected by Sieber "in insula Cuba." I have not seen a type, but there can be no doubt that Poeppig's specimens from Cuba, Prov.

Camaguey, " ad las Pedras," February, 1824, which have been distributed as *S. occidentalis* Bosc represent the typical form of this species. Unfortunately this name cannot be used on account of the older *S. occidentalis* Walter (1788). This Willow is apparently mentioned next in 1824 by Elliott (Sketch Bot. S.-Carol. Georg. II. 671) who says: " We have a remarkable variety of this plant [*S. nigra*], the young branches and leaves pubescent, somewhat hoary, almost tomentose; but I have been able to perceive no other difference either in the shape or size of the leaves of the tree or in the period of flowering." To this willow Nuttall (N. Am. Sylva I. 79 [1843]) refers as follows: " *S. nigra*, Mich. Arb. vol. 2, plate 125, fig. 1. A variety of this tree occurs in South Carolina and Florida in which the leaves are villous and the scales of the ament densely lanuginous. In the herbarium of Mr. Schweinitz it is marked, on the authority of Elliott, as a species *S. subvillosa*." This name has to be regarded as nomen nudum. The next name given to our willow is *S. longipes* Shuttleworth apud Andersson (1858). Andersson describes at the same time a var. *pubescens* with the synonym *S. gongylocarpa* Shuttleworth, and he cites for both: " Hab. prope St. Marks, Florida: Ruel " (corrected in Proc. Am. Acad. IV. 53 [Sal. Bor.-Am. 7] into Rugel). In this publication Gray says in a note to var. *pubescens:* " This is the *S. subvillosa* Ell. in Herb. Schweinitz ex Nutt. N. Am. Sylva, 1, p. 79, — a work to which Prof. Andersson had no access, — also mentioned in Ell. Bot. S. Car. & Georg. 2, p. 671, under *S. nigra*." So far as I can see the typical *S. longipes* as well as the type of var. *pubescens* cannot be separated, but represent only extreme states of the same form. In 1858 Andersson made no mention of *S. occidentalis* Bosc but in 1867 (Monog. Salic. 23) he treats it as a separate species, and refers *S. longipes* as a subspecies to *S. nigra* with the varieties *venulosa* and *gongylocarpa*, now using the last name for his var. *pubescens* of 1858. The same treatment is given by him in the Prodromus in 1868, but here he reduces *S. longipes* to a distinct variety of *S. nigra* with the forms *venulosa* and *gongylocarpa*. In his remarks to *S. occidentalis*, Andersson, in 1867, said that this species " perspectis formis intermediis *S. nigrae*, quas *venulosam* et *gongylocarpam* hic nominavi" is connected with *S. nigra*, and in 1868 he stated that f. *venulosa* is " ad *S. nigram* transitus " while f. *gongylocarpa* is " *S. occidentali* proxima." There is hardly any doubt that *S. occidentalis* from Cuba and *S. longipes* (sensu str.) from Florida cannot be separated even as varieties. The last one has been again described by Chapman (1860) as *S. floridana* [1] and by Small (1913) as *S. amphibia*. Andersson's f. *venulosa* represents a different form with which I have to deal later.

According to the material I have seen the range of typical *S. longipes* extends from Cuba to northern Florida from which state I have examined specimens from the following counties (south to north): Monroe, Dade, Lee, Brevard, Lake, Volusia, Taylor, Wakulla, Franklin, Columbia, Duval, Palm Beach, and from Folkston, Charlton County, in adjacent south-

[1] *S. floridana* Small, Florida Shrubs 9 (1913), with 2 stamens is unknown to me, and I do not know whether or not it represents Chapman's species.

eastern Georgia. In northern Florida (Franklin, Wakulla, Leon, Gadsden, Jefferson, Duval Counties), in Georgia (Charlton and Richmond Counties), South Carolina (Aiken, Charleston and Saluda Counties), in eastern North Carolina (Craven County) and in the southeastern corner of Virginia (Norfolk County at Dismal Swamp) *S. longipes* is represented by a somewhat uncertain form which I at present cannot separate from what I call var. *venulosa* from the west. (See also my remarks under *S. Harbisonii* below); while north of the 36th parallel and in the central states var. *Wardii* takes the place of the typical form. The separation of these three varieties is by no means easy, and it needs well collected material properly to determine each of them.

11b. **S. longipes** var. **venulosa** Schneider in Bot. Gaz. LXV. 14 (1918). — *S. Pitcheriana* Barratt, Salic. Am. No. 22 (1840), nomen nudum, secundum specimen originale. — ? *S. nigra* **S. marginata* Andersson in Svensk. Vetensk. Akad. Handl. VI. 21 (Monog. Salic.) (1867). — ? *S. marginata* Wimmer in Herb. Vindob. ex Andersson, l. c., pro synon.; Small, Fl. S.E. States 341 (1903), ex parte. — *S. nigra* *** *S. longipes venulosa* Andersson in Svensk. Vetensk. Akad. Handl. VI. 22 (Monog. Salic.) (1867). — *S. podocarpa* Engelmann MS. in Herb. Gray, confer Andersson, l. c. 22. — ? *S. nigra* α. *marginata* Andersson in De Candolle, Prodr. XIV.[2] 201 (1868). — *S. nigra* γ *longipes* 1° *venulosa* Andersson, l. c. — Heller in Contrib. Herb. Frankl. & Marsh. Coll. I. 26 (Bot. Expl. S. Tex.) (1895). — *S. occidentalis* var. *longipes* Bebb in Gard. & For. VIII. 363 (1895), ex parte. — Sudworth, in Bull. U.S. Dept. Agric. Div. For. XIV. 119 (Nomencl. Arb. Fl.) (1897), ex parte. — *S. nigra* Heller in Contrib. Herb. Frankl. & Marsh. Coll. I. 26 (1895), sec. spec. citat. No. 1621, non Marsh. — *S. longipes* Glatfelter in Rep. Mo. Bot. Gard. IX. 43, t. 6, fig. 4 (1897), pro parte, non Shuttleworth. — Small, Florida Shrubs, 9 (1913), pro parte.

As may be imagined from the synonymy the history of this variety is a rather complicated one. It was first mentioned by Barratt as follows: "22. *Salix Pitcheriana* *Barratt, MSS. Hab. Arkansas. — Dr. Pitcher. Sea Islands of Georgia. This undescribed species is allied to *S. nigra*. I possess specimens which have been obligingly communicated by John Carey, Esq., of New York. This willow is killed by the winters of the Northern States." According to this *S. Pitcheriana* is a nomen nudum. I have seen co-types in Herb. G. and N., "raised from cuttings sent from Georgia to Mr. Carey." The name *S. marginata* Wimmer which is the next oldest one, was founded on a specimen of Drummond's "ad New Orleans America borealis" in Herb. Vindob. I have not yet seen the type but I have no doubt that Drummond's No. 303, New Orleans 1832, in Herb. N. can be regarded as a co-type. It seems to me to be referable to var. *venulosa*, but the ovaries of the New York specimen are partly pilose, and Wimmer's form needs further observation. Small has used the name *S. marginata* "Weimer" for a species which in my opinion partly belongs to *S. Harbisonii*. When Andersson in 1867 first described his f. *venulosa* he did not cite a type, but only said: "Hab. in Nova Mexico," but in 1868 he

cites "Wright n. 1879." This number, in all probability, did not come from New Mexico but from the banks of the Rio Grande in Texas or further north[1]. I have seen two sheets of this number (in Herb. G. and N.) and there can be no doubt that f. *venulosa* Andersson has nothing to do with *S. nigra*. It represents, in my opinion, a distinct variety of *S. longipes* which has been named *S. podocarpa* by Engelmann in Herb. G. (on a sheet of Lindheimer, from the Pedernales River, Texas, 1847). This name has never been rightly published and was only mentioned by Andersson (1867). I have seen good material of var. *venulosa* from the following counties of southern and central Texas: Uvalde, Bandera, Kerr, Gillespie, Kendell, Blanco, Hood, Johnson, and as I said before, I refer to this variety forms from the southeast as indicated under *S. longipes* on p. 26. If Drummond's *S. marginata* from New Orleans in Louisiana should really belong to var. *venulosa*, this station would form a connecting link between the otherwise rather widely separated ranges. The var. *venulosa* should be looked for along the coast from eastern Texas to western Florida. I am still very badly acquainted with the *Salix* flora of this region because there is but little material at my disposal, and I can get no reliable information from existing Floras.

There are Texan specimens before me which much resemble var. *Wardii*, but if we take the shape of the stipules as a character of decisive taxonomic value, we have to refer all the material from Texas to var. *venulosa* which has the pointed stipules of typical *longipes*. See also my remarks under the following variety.

11c. **S. longipes**, var. **Wardii** Schneider in Bot. Gaz. LXV. 22 (1918). — *S. cordata* 2. *S. angustata discolor* Andersson in Svensk Vetensk. Akad. Handl. VI. 159 (1867), sec. specim. in G. a cl. Andersson determ. — *S. cordata* β, *angustata* 1° *discolor* Andersson in De Candolle, Prodr. XVI.[2] 252 (1868). — *S. nigra* var. *Wardii* Bebb apud Ward in Bull. U.S. Nat. Mus. XXII. 114 (Guide Fl. Wash.) (1881); apud Watson & Coulter, Gray Man. ed. 6, 481 (1890). — *S. Wardii* Bebb in Gard. & For. VIII. 363 (1895). — Glatfelter in Science, n. s. II. 582 (1895). — Britton & Brown, Ill. Fl. I. 495, fig. 1174 (1896); ed. 2, I. 593, fig. 1453 (1913). — Sargent, N. Am. Silva, IX. 107, t. 464 (1896). — Gattinger, Fl. Tenn. 66 (1901). — Mohr in Contrib. U.S. Nat. Herb. VI. 465 (Pl. Life Ala.) (1901). — Robinson & Fernald, Gray's Man. 321, fig. 641 (1908). — Shreve & others, Pl. Life Maryland, 423 (1910). — *S. longipes* Glatfelter in Rep. Mo. Bot. Gard. IX. 43, t. 5, figs. 3–4, t. 6, figs. 3, 5, 8–10; t. 7, figs. 1–6 (1897), pro parte, non Shuttlew. — Rydberg in Britton, Man. 313 (1901), pro parte. — Small, Fl. S.E. States, 341 (1903), pro parte. — Sargent, Man. Trees N. Am. 169 (1905), pro

[1] The specimen in Herb. G. is expressly marked as collected in 1851. According to Gray (in. Am. Jour. Sci. ser. 3, XXXI. 13 [1886] in Sargent, Sci. Papers Gray, II, 469 [1889]). Wright went in the spring of 1851, after having remained more than a year in central Texas, with Col. Graham's party to the border between Mexico and the United States. "He returned with him without reaching farther westward than about the middle of what is now the territory of Arizona." The specimens were probably collected in June in the southern parts of central Texas where var. *venulosa* seems to be very abundant.

parte. — Hough, Handb. Trees 76, figs. 89–90 (1907), pro parte. — Britton & Shafer, N. Am. Trees, 186 (1908), pro parte. — Ball in Elys. Mar. III. 21 (1910), pro parte. — This variety has been well treated by Glatfelter (1897) who, however, did not separate it from the typical *S. longipes*. The following statement of this excellent observer has certainly not lost anything of its value since he wrote it 21 years ago: " Whether or not *S. longipes* should be divided into several forms or varieties is a question, owing to insufficient accumulation of material, not yet determinable. In view of what we know at the present day of the instability of some of our species of Willows, it does not seem to fill the present demands of the scientific idea, to set up a number of forms from a limited number of herbarium specimens, and, besides, incomplete as we often find them. Without careful observations, such work must inevitably prove defective. The plant must be seen in its habitat and in quantity before a just conception of all its characters can be formed. In this way the supposedly good form will often vanish, to be supplanted by easily recognizable variations." Glatfelter did not have very copious material of the typical *S. longipes* at his disposal, neither was he well acquainted with the forms I refer to var. *venulosa*. So far as I can see, these varieties inhabit different geographical areas which, however, meet together in certain regions, and it is mostly in these that we may observe intermediate forms. The range of var. *Wardii* is not yet sufficiently known. The type was found by Ward near Washington, D.C., where it apparently reaches the most northern point of its distribution. The northern borderline thencefrom runs along the Potomac River to Allegany County, Maryland. The next station from which I have seen a specimen is Upshur County in W. Virginia, and it has been reported from Lexington in Fayette County, Kentucky. I have not yet seen specimens or reports of it from West Virginia, Ohio, or Indiana. In Illinois it was collected in St. Clair and Madison Counties, and it seems to show its best development in Missouri, from which I have seen specimens from the following counties: (east to west) Marion, Ralls, Pike, St. Louis, St. François, Madison, Iron, Washington, Phelps, Shannon, Carter, Howell, Wright, Christian, Taney, Stone, McDonald, Newton, Jasper, Jackson. In Kansas I have seen it only from the southeast corner (Cherokee County), a specimen from the Kiowa County being doubtful. From Oklahoma I have had specimens before me from Ottawa, Drage, Rogers, Creek and La Flore Counties in the northeast and east, while those from Comanche County in the southwest may probably better be referred to var. *venulosa*. The southern borderline of its range apparently runs from La Flore County in Oklahoma through adjacent western Arkansas (Howard County) and northwestern Arkansas (Benton and Carroll Counties) and southern Missouri, and northern Tennessee (Davidson and Robertson Counties); it has been collected by Harbison as far south as northeastern Mississippi (on the Tennessee River, near Iuka, Tishomingo County), and Mohr cites it from the northwestern corner of Alabama (Lauderdale County, Tennessee River). Farther to the east I have seen var. *Wardii* from Natural Bridge, James

River, Rockbridge County, Virginia. It also occurs in Fairfax County and Elizabeth County (near Buckroe), Virginia, and it is possible that the form mentioned under var. *venulosa* from Norfolk County (Dismal Swamp) belongs to var. *Wardii* or that both varieties meet in the southeastern corner of Virginia.

The best way to distinguish var. *Wardii* is by the obtuse stipules, all the other characters are apparently too unstable, but, of course, the extremes of each variety seem to be distinct. Collectors should look for var. *Wardii* in the southern part of Ohio, Indiana and Illinois as well as in different parts of West Virginia, western Virginia, Tennessee, northern Alabama, northern Missouri and Arkansas.

12. **S. Harbisonii**, sp. nov. — *S. marginata* Small, Florida Shrubs, 9 (1913), non Wimmer. — *S. nigra* Harper in Sixth Ann. Rep. Florida Geol. Surv. 401 (1913), ex parte, non Marshall. — Frutex (fide cl. Harbison) plerumque altus vel arbor ad 10–14 m. alta, trunco ad 30 cm. crasso cortice sulcato rugoso interdum squamato vestito, ramulis fragilibus; ramuli plerumque ab initio glabri vel novelli tantum satis sparse pilosi (sed interdum novelli ut in *S. longipede* dense breviter tomentosi), hornotini glabri, olivacei vel ut annotini obscure purpurascentes vel rubro-fusci, vetustiores fusco-cinerascentes; gemmae bene evolutae nondum visae; folia matura papyracea, in typo infima minora linearia, lanceolata, elliptico-lanceolata, rarius latiora obovato-lanceolata, 1 : 0.2 ad 2.5–3.5 : 1 cm. magna, vel in aliis speciminibus majora oblanceolata ad 5 : 1.5 cm. magna, basi acuta ad rotundata, apice acuta ad breviter acuminata, superiora majora (normalia) anguste vel lineari-lanceolata, ad 5 : 1 vel 7 : 0.9 vel ad 10 : 1.6 cm. (interdum ad 13 : 2.7 vel in Harper No. 1499 ad 15 : 2 cm., basi obtuse cuneata, ab infra medium ad apicem sensim acuminata) magna, basi obtuse vel acute cuneata, apice plus minusve acuminata et saepe breviter caudata, margine satis dense breviter glanduloso-serrato-denticulata (vel in Harper No. 1499 subserrulata), dentibus circ. 3–4 pro 5 mm., superne ab initio (costa saepissime puberula vel tomentella excepta) glabra, intense viridia, ut in *S. nigra* nervata reticulataque, sed in epidermide haud stomatifera vel stomatibus sparsis (rarius numerosis) tantum secundum costam praedita, subtus ab initio glaberrima vel in costa plus minusve sericeo-pilosula (surculorum interdum distinctius pilosa), inferiora plus minusve, superiora distincte glaucescentia, pruinosa, costa flavescente plus minusve elevata, ceterum ut superne graciliter nervata et angustissime reticulata; petioli 2–10 mm. longi, superne sulcati et plus minusve tomentelli, ceterum glabri, flavescentes, apice (basi folii) saepe minute glanduliferi; stipulae nullae vel minimae, semicordatae, acutae, glanduloso-denticulatae vel in ramis vegetioribus (Harbison, No. 17, Goldsboro, N.C.) semicordatae, ad 10 mm. longae, acutae, intus interdum pauci-glandulosae et pilosulae (in speciminibus paucis satis semicordato-subrotundae 2–5 mm. longae intus eglandulosae et iis *S. longipes* var. *Wardii* non absimiles). Amenta serotina, pedunculis initio pilosis demum saepe glabrescentibus 5–25 mm. longis foliatis

suffulta, rhachi villosula; mascula subdensiflora, pedunculo vix ad 1 cm. longo excluso demum vix ultra 6:1 cm. magna, vulgo leviter arcuata; bracteae ovatae vel ovato-oblongae, obtusae vel subacutae, flavescentes, venosae, utrinque breviter villosae vel extus ad apicem plus minusve glabrae; stamina vulgo 5–7 (rarius 3 vel 9), filamentis 1/2–1/3 dense villosis bractea demum subduplo longioribus, antheris flavis parvis globosis; glandulae 2, ventralis pleraque late ovato-rhombica, truncata vel subrotundata, dorsalis pleraque irregulariter (2–)3-partita (saepe digitata); amenta feminea sub anthesi circ. 3–5 : 0.7 cm., fructifera pedunculo ad 10–15 mm. longo excluso 5–7:1.5 cm. magna, satis laxiflora; bracteae ut in floribus masculis vel plerumque magis lanceolatae acutiores; ovaria ellipsoideo-conica, glaberrima; styli distincti sed brevissimi (vix ad 0.4–0.5 mm. longi), apice vulgo divaricato-bifidi, stigmatibus minimis emarginatis pro sectione typicis; pedicelli graciles, sub fructu 2–3 mm. longi; glandula 1, ventralis, late ovata, apice truncata vel rotundata, basi semiamplectens, quam pedicellus initio 2–3–, dein 4–6plo brevior; fructus maturi e basi subacuta ad subrotunda ellipsoidei, plus minusve rostrati, pedicello excluso (5–)6 mm. longi.

TYPE LOCALITY: Savannah, Chatam County, Georgia.

SPECIMENS EXAMINED: GEORGIA. Chatam County: Savannah, in border of swamp, April 5, 1918, *T. G. Harbison* (No. 5, f., fr., type; A.; "wide-spreading tree 30 ft. tall and 10 in. in diameter; bark rough and scaly in thick narrow ridges; twigs brittle-jointed"; folia superne ut videtur estomatifera); on ditch bank, same date, *T. G. Harbison* (No. 2, m. syntype; A.; "small brittle-jointed shrub"). Charlton County: Trader's Hill, on bank of St. Mary's River, Aug. 11, 1902, *R. M. Harper* (No. 1499, st.; N.; foliis ad 14:2 cm. magnis satis serrulato-denticulatis subtus paullo glaucescentibus, stipulis distinctis); April 3. 1918, *T. G. Harbison* (Nos. 1, fr. juv., 2, m.; A.; "small tree; bark rough; twigs brittle-jointed"; stomata in foliis superne tantum pauca ad costam visa). Richmond County: Augusta, on river bank, April 6, 1918, *T. G. Harbison* (No. 7, f.; A.; "large tree; bark rough and scaly; twigs brittle-jointed"; stipulis minimis acutis, foliis juvenilibus sed subtus leviter glaucescentibus); in swamp near the river, April 6, 1918, *T. G. Harbison* (Nos. 8, m., 9, f.; A.; "large scaly barked shrub"; in specimine femineo stipulae plus minusve evolutae semicordato-subrotundae, obtusae, 2–5 mm. longae iis *S. longipes Wardii* non absimiles; forma porro observanda); in swamp, same date, *T. G. Harbison* (No. 4, m.; A.; "large shrub or small tree; bark shallowly furrowed: twigs brittle-jointed"; forma porro observanda). Stephens County: Toccoa, along creek, April 10, 1918, *T. G. Harbison* (No. 3, m.; A.; "small tree; bark shallowly furrowed; twigs brittle-jointed"). Decatur County: Bainbridge, on bank of Flint River, March 28, 1918, *T. G. Harbison* (Nos. 1, m., 2, f.; A.; "a straggling tree 40 ft. tall and 10 in. in diameter: bark scaly; twigs brittle-jointed"; this form may be referable to the form of *S. nigra* mentioned on p. 6); on river bank, March 28, 1918, *T. G. Harbison* (No. 3, f.; A.; "a tree nearly a ft. in diameter and 35 to 40 ft. tall; bark rough, furrowed and scaly; twigs very brittle-jointed"; folia juvenilia subtus. satis glaucescentia); Climax, in swamp, March 28, 1918, *T. G. Harbison* (Nos. 1, f. [satis ad *S. nigram* spectans], 2, m.; A.; "tall upright shrub with brittle-jointed twigs"; omnibus partibus juvenilibus satis griseo-tomentosis, foliis subtus glaucescentibus).

FLORIDA. Franklin County: Apalachicola, on edge of swamp, March 26, 1918, *T. G. Harbison* (No. 9, m.; A.; "small shrub 5 ft. tall"; forma foliis juvenilibus porro observanda).

South Carolina. Aiken County: Hamburg, along Savannah River, September 24, 1913, *J. Tidestrom* (No. 6950, st.; M.). Beaufort County: Yemassee, open moist ground, April 22, 1917, *C. F. Batchelder* (fr. im.; stomata superne sparsa). Charleston County: Charleston, in low ground, April 8, 1918, *T. G. Harbison* (Nos. 1, f., 2, m.; A.; "small slender tree; bark shallowly furrowed; twigs brittle-jointed"; omnibus partibus juvenilibus tomentosis); in swamp, same date, *T. G. Harbison* (No. 3, fr. im.; A.; "small tree; twigs brittle-jointed: bark furrowed but not scaly; omnibus partibus multo magis glabrescentibus quam in no. 1–2; stomata superne in foliis non visa; No. 4, m.; A.; "small tree, twigs brittle-jointed"; agrees well with type; No. 5, m.; A.; "large shrub; twigs brittle-jointed"; ut praecedens; No. 7, m.; A.; "shrub 6 ft. tall; bark smooth; twigs brittle-jointed"; ut praecedens); Isle of Palms, May 30, 1902, *C. R. Ball* (No. 56, st.; O.; "12 ft."; stomata superne pauca ad nervos, folia ad 13:2.5 cm. magna, petiolis 6–9 mm. longis). Georgetown County: Georgetown, in low ground, April 26, 1918, *T. G. Harbison* (No. 5, fr.; A.; "tall shrub; twigs brittle-jointed").

North Carolina. Wayne County: Goldsboro, in low ground, June 8, 1918, *T. G. Harbison* (No. 17, st.; A.; "small tree"; folia ad 12:2.6 cm. magna, superne stomatibus subnumerosis praedita; stipulae semicordatae plus minusve acutae, intus glanduliferae). Columbus County: swamps, June, 1895, *W. W. Ashe* (No. 1325, st.; C.; forma incerta).

Virginia. Smyth County: about Falls of Holston River, 700 m., June 8, 1892, *J. K. Small* (fr.; A., C., M.; forma satis ad *S. Harbisonii* accedens). Norfolk County: borders of Dismal Swamp, May 16, 1877, *Th. Morong* (m., fr. im.; N.; forma porro observanda, ad *S. longipedem* accedens, sed folia superne sparse stomatifera).

The specimens referred by me to *S. Harbisonii* look, at the first sight, very much like *S. longipes* (especially var. *venulosa*). I would have taken them for this species if it were not for the brittle-jointed twigs. Besides this the presence of stomata on the upper side of the leaf, and the minute glands on the inner surface of the stipules induced me to describe a new species. After all, however, it seems hardly possible to draw a sharp line between it and *S. longipes venulosa* which has been collected in almost every locality where *S. Harbisonii* is found. I first thought that these forms might represent hybrids between *S. longipes* and *S. nigra*, a fact that would easily explain the brittle-jointed twigs, the presence of the stomata in the upper surface of the leaves, and of the glands on the stipules. *S. nigra* is, however, known only from a few of the localities where *S. Harbisonii* is growing, and this species seems to be the prevailing one in most of the places where it is found. It cannot be regarded as a mere variety of *S. longipes* on account of the brittleness of the twigs, even if we would lay no stress upon the presence of the stomata which after all seems to be a rather important taxonomic character. *S. Harbisonii* certainly needs a closer study in the field, and a final statement as to its specific value or hybrid origin can only be made when we have become much better acquainted with those forms of *S. nigra* which I have enumerated on p. 8. *S. nigra* may be more frequent than we have reason to believe now, and if it should be found together with *Harbisonii* the hybrid origin of this species could be easily understood.

I shall be glad to receive material of all the doubtful forms of the

*Pleonandrae* which I have mentioned, but it is necessary to collect from the same plant at different times, because only well-collected material will be sufficient to make more definite statements possible. Besides this it is very important that the collector make notes with regard to the habitat, the habit, the associated species of Salix, and whether the branchlets are more or less brittle or tough at the joint. The last character seems to be of great taxonomic value for the separation of the tough-jointed *Bonplandianae* from the very brittle-jointed *Nigrae* and the (more or less) brittle-jointed *Lucidae* and *Amygdalinae*.

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## A PHYTOGEOGRAPHICAL SKETCH OF THE LIGNEOUS FLORA OF KOREA

E. H. Wilson

Korea, or Chosen, as it is now designated by the Japanese, is a peninsula bounded on the east by the Japan Sea, on the south and west by the Yellow Sea, and on the north by Manchuria and the Primorsk province of eastern Siberia from which it is separated by the Yalu River, Paiktu mountains and the Tumen River. Until quite recently it was styled the "Hermit Kingdom" by peoples of western lands and it had little or no intercourse with the outside world. The whole peninsula (including adjacent islands) is confined within Lat. 33° 12′ and 43° 02′ N. and Long. 124° 13′ and 130° 54′ E. and has a total area of 84,173 square miles (English). Geologically speaking nearly four-fifths of Korea is of granites and highly metamorphosed rocks of Pre-Cambrian age. In the central parts between Lat. 38° and 40° N. and stretching almost from sea to sea is an area of Paleozoic rocks, chiefly mud-shales, slates, and a little limestone; in the southeast is an area of Mesozoic limestones with intrusive porphyritic rocks and isolated outcroppings of this combination of rocks obtrudes itself in other parts of Korea. Basalt underlies much of the peninsula and in the volcanic areas — Paiktu mountains, highlands south of Gensan, the islands of Quelpaert (Sai-shu-to) and Dagelet (Ooryöngtō) — it has been forced to the surface and is surmounted by trachyte lavas. Each of these geological formations has certain plants peculiar to it. For example, Larch (*Larix dahurica* var. *Principis-Rupprechtii* Rehd. & Wils.) grows only on the recent volcanic soils of the Paiktu region and there forms vast forests; a Birch (*Betula Schmidtii Regel*), one of the most valuable of Korean hardwood trees, is confined to the granites and metamorphic rocks; a Lilac (*Syringa dilatata* Nakai) is found only on the paleozoic rocks of north-central Korea. The climate is the best in the Far East and the country is destined to become the health resort of the Orient. It is essentially continental in character but in the extreme south and east-southeast, near the coast it is moderated by the influence of the Japan current — a warm ocean stream similar to our Gulf Stream. On Quelpaert Camphor and Orange trees grow at sea-level and the temperature there seldom falls below the freezing-point; in the

extreme north in the valleys of the Yalu and Tumen rivers it falls as low as twenty below zero Fahrenheit — that is 52° F. of frost; round Keijyo or Seoul, the capital of Korea, the rivers freeze solid or nearly so and in winter all vehicular traffic crosses the ice where bridges are not available.

Korea is a very mountainous country; there are no plateaus nor plains worthy of the name and the only flat land is confined to narrow valleys and estuaries of the rivers. The mean height of the broken country is from 300 to 600 m. and that of the mountains from 1000 to 1800 m.; the highest peak is Paiktu-san 2700 m. but there are many about 2000 m. high. Agriculture is the staple industry of the people and the whole of the most fertile soils in the most accessible and climatically best parts of the country have been brought under cultivation. Since the winters are very cold much fuel is necessary and unfortunately coal is found in one or two places only and the people are almost entirely dependent upon wood for fuel. These two facts, and more especially the absence of coal, have been mainly responsible for the disappearance of the forests from the greater part of the peninsula. It is true that in the extreme north, which is very difficult of access and the population very sparse, magnificent forests of great extent remain and on mountains, like the Diamond Mts. where Buddhist monks have managed to maintain their influence and round royal tombs the vegetation has been very little disturbed, but over fully two-thirds of the whole country the forests have been destroyed and where no cultivation is to-day attempted coarse grasses, shrubs and scrub Pine are all that remain. These constitute the chief fuel supply of the country. The scrub Pine is *Pinus densiflora* S. & Z. and this has been extensively planted both under the old Korean régime and by the present Japanese government and to the casual observer appears to be almost the only tree in the country. It is hacked and maimed annually to supply fuel yet it manages to maintain itself under the most adverse conditions, in the poorest of soils and on the barest of rocks; where left alone it develops into tall, handsome trees. From the railway which traverses the country from southeast to northwest the impression left on the minds of nearly all travellers is of treeless, scrub and grass clad hills, bare rocks, low scrub Pine scattered over mountain-slopes with patches of cultivation in the valleys. In winter when the crops are harvested and the grass is shorn and brown, the whole countryside looks cold, drab and cheerless. However, a more intimate acquaintance, a closer study, will show that, in spite of the naked appearance in winter and the marked absence of trees from accessible areas and routes, Korea can really boast a fairly extensive flora comparatively rich in trees, shrubs, and in herbs having conspicuous and beautiful flowers. Compared with that of its neighbours, China and Japan, the flora of Korea is much less rich and varied, yet in individuals of striking merit it has many claims, and these none the less strong for remaining virtually unknown until quite recently. For, although small collections have been made from time to time since 1854, when Baron Alexander Schlippenbach gathered the first plants in Korea, no real investigation of the flora had been undertaken prior to the country's annexation

by Japan in 1910. Since that date the Government-General has systematically undertaken an investigation of the natural resources of Korea and the botanical work is in the hands of Dr. T. Nakai. So far 2,822 species, varieties and forms, belonging to 780 genera, representing 151 families, have been recorded, but the work is by no means completed. About one-fourth of these are woody. Most of the families which occur in Japan, north China and northeast Asia are present but often much reduced in number of representatives. For example: — the family of *Magnoliaceae* is represented by two genera (Magnolia, Schisandra) with three species. The most prominent family that is missing is *Hamamelidaceae*. A genus that one might expect to be present and which is not is Cercidiphyllum.

Now whilst the seas are natural phytogeographical barriers the political boundaries of Korea, — i.e. the Yalu and Tumen rivers and the Paiktu mountains — are not and the flora is essentially part of that of the great region of northeast Asia including Manchuria and the northernmost parts of China proper as far west as Mt. Wutai in Shansi province. Of woody plants at least one genus (Pentactina) and a limited number of species (*Viburnum Carlesii* Hemsl., *Cornus officinalis* S. & Z., *Forsythia ovata* Nakai and a few others) are endemic, quite a number such as *Abies holophylla* Maxim., *Rhododendron Schlippenbachii* Maxim. do not cross the Yalu watershed to the plains of Manchuria, but the majority are widespread on the continent of northeast Asia and many cross to Hokkaido and to northern Hondo in Japan proper. Of the latter mention may be made of *Alnus japonica* S. & Z., *Rhododendron brachycarpum* G. Don, *Styrax obassia* S. & Z. Further, a few species, including five (*Quercus glandulifera* Bl., *Q. aliena* Bl., *Q. dentata* Thunb., *Q. serrata* Thunb., *Q. variabilis* Bl.) of the six species of deciduous leafed Oaks, are widely distributed in China and Japan. The two volcanic islands, Quelpaert off the extreme south, and Dagelet off the east coast, in the Japan Sea, are peculiar. The first-named, with its peak, Hallai-san, 1952 m. high, has largely a Japanese flora, and is marked by the presence of broad-leaf evergreens in great variety. A few species, for example, *Maackia Fauriei* Nakai, are possibly endemic and pure woods of Hornbeam (*Carpinus laxiflora* Bl. and *C. Tschonoskii* Maxim.), with *Daphniphyllum macropodum* Miq. and *Taxus cuspidata* S. & Z. as conspicuous undergrowths are a characteristic feature between 1000 m. and 1300 m. Such woods are unique in the Orient. The trifoliolate Orange (*Poncirus trifoliata* Raf.) is indigenous, growing in the beds of torrents or among boulders; nowhere else in my travels have I seen this plant truly wild. No species of Spiraea, Deutzia nor Philadelphus grows on Quelpaert, yet they are common shrubs on the mainland. On the other hand, *Hydrangea petiolaris* S. & Z., *Schizophragma hydrangeoides* S. & Z. and *Ostrya japonica* Sarg., unknown on the mainland, are common on this island. Two other very common plants are *Rhododendron Weyrichii* Maxim. and *R. poukhanense* Lév.; the first named does not grow elsewhere in Korea whereas the latter is widely spread through the peninsula. Such typical Japanese trees as *Pinus Thunbergii* Parl., *Torreya nucifera* S. & Z., *Myrica rubra* S. & Z. and *Machilus Thunbergii*

S. & Z., *Magnolia kobus* DC. are indigenous in Quelpaert but grow nowhere else in Korea. The Fir on the island is an undescribed species, similar in habit to *Abies Veitchii* Lindl., has cones like *A. sachalinensis* Mast., but less resinous, and bark like that of *A. nephrolepis* Maxim. It just crosses to the mainland but finds its northern range on Chiri-san about Lat. 35° N. The Chiri range is interesting phytogeographically since it is the southern limit of such characteristic Korean plants as *Rhododendron Schlippenbachii* Maxim., *Pinus koraiensis* S. & Z., *Abies holophylla* Maxim., *A. nephrolepis* and the widely spread *Picea jezoënsis* Carr. and *Alnus hirsuta* var. *sibirica* Schneid.; also it is the only region in Korea where grow *Stewartia pseudocamellia* Maxim. and *Rhododendron Tschonoskii* Maxim., two typical Japanese plants.

The flora of Dagelet Island is most singular, being much more closely related to that of Japan than to that of Korea. The Japanese *Pinus parviflora* S. & Z. and Hemlock, *Tsuga Sieboldii* Carr., find their western limits on this island and woods of a Beech (*Fagus multinervis* Nakai), considered endemic, are a feature of the forests high up on the mountains. No Beech grows on the mainland of eastern Asia nor in China until the province of Hupeh is reached. Among other endemic species worthy of mention are *Acer Okamotoi* Nakai, *Abelia coreana* Nakai, *Sambucus pendula* Nakai, *Cotoneaster Wilsonii* Nakai. The Keaki, *Zelkova serrata* Mak., common to Japan and Korea is also indigenous on Dagelet Island and so, too, is *Pinus densiflora* S. & Z. The Chinese Juniper (*Juniperus chinensis* L.) is wild on the sea cliffs and has huge trunks though the trees are not tall. The lovely *Viburnum Carlesii* Hemsl., a littoral species, also is indigenous, but has so far not been found on the contiguous east coast of Korea although it grows in one or two localities on the west coast and on Quelpaert. These two insular outposts of the Japanese flora are the more remarkable when it is remembered that although both are volcanic their basalt and trachyte lavas prove that they belong to the Korean and not to the Japanese system of volcanoes.

Omitting the foregoing anomalies the flora of Korea is specifically and markedly different from that of Japan and China. Yet though species are limited, genera are well represented, and the small size of the country, its severe climate, and the destruction wrought during centuries of deforestation duly considered, it compares not unfavorably with that of contiguous and adjacent regions of the same latitudes. The whole flora of the Korean peninsula is essentially boreal in character and its outstanding feature is the almost complete absence of broad-leaf evergreens. Of these fifteen species, *Zanthoxylum alatum* var. *planispinum* Rehd. & Wils., *Ilex cornuta* Lindl., *Evonymus radicans* Sieb., *Buxus microphylla* var. *koreana* Nakai, *Rhododendron brachycarpum* G. Don, *R. micranthum* Turcz., *R. chrysanthum* Pall., *R. parvifolium* Adams, *R. confertissimum* Nakai, *R. Redowskianum* Maxim., *Ledum palustre* L., *Vaccinium Vitis-idaea* L., *Phyllodoce coerulea* Bab., *Empetrum nigrum* L. and *Sasa spiculosa* Mak. only are found there. The first six are confined to central and southern Korea, the Sasa, although

widespread, is nowhere very abundant, the others are alpine plants and grow only in central and northern Korea. Except the social, alpine plants and the Sasa these broad-leaf evergreens are local in their distribution, few in numbers and nowhere a conspicuous feature of Korean vegetation. Mistletoe both with a greenish white and reddish fruit is a pest everywhere.

The deciduous broad-leaf trees which compose the woods and forests belong to familiar northern genera and include several species each of Willow, Alder, Birch, Poplar, Hornbeam, Elm, Oak, Maple, Cornel, Nettle Trees, and one or two each of Cherry, Bird Cherry, Crab Apple, Wild Pear, Ash, Walnut, Sweet Chestnut, Spiny Elm, Honey Locust, Linden, Apricot, Sophora, Koelreuteria, Phellodendron and the Keaki. The woods and forests of these trees are left on steep, rocky mountains unsuited to agriculture and where the soil is poor, so they are not large when compared with their congeners in America, Europe or Japan. Occasionally, when for religious or sentimental reasons groups of trees or individuals have been allowed to remain in valleys and by roadsides, good specimens may be seen, but in general Korean broad-leaf trees are small and their timber of less value than that of the same species from Manchuria or Hokkaido. The largest of these Korean trees is *Populus Maximowiczii* Henry which in the sparsely peopled north is often 100 ft. tall with a trunk 20 ft. in girth. A Black Ash (*Fraxinus mandshurica* Rupr.) ranks next but I have seen in Hokkaido far larger trees of this species, and logs rafted down the Yalu from its Manchurian tributary show that in Manchuria it is also a larger tree. The Mongolian Oak (*Quercus mongolica* Fisch.) probably ranks third in size but on a part of the Diamond Mts. only did I see any really noteworthy examples of this Oak. The most widely distributed trees are *Quercus mongolica* Fisch., *Betula Ermanii* Cham., and *Prunus serrulata* var. *pubescens* Wils. which are common from Quelpaert to the Manchurian border and northward. Almost as common are *Alnus hirsuta* var. *sibirica* Schneid., *Populus tremula* var. *Davidiana* Schneid., *Betula davurica* Pall., *B. japonica* Sieb., *Quercus dentata* Thunb., *Phellodendron amurense* Rupr., *Ulmus japonica* Sarg., *Acer pictum* Thunb., *Salix koreensis* Anderss. and *Maackia amurensis* Rupr. & Maxim. Trees with the least distribution are *Cornus officinalis* S. & Z., and *Sophora japonica* L., which are spontaneous on a mountain slope about thirty miles northeast from Keijyo and are found wild nowhere else in Korea. The genus Salix is richest in species and some like *S. nobilis* Nakai, *S. cardiophylla* Trautv. & Mey. and *S. koreensis* Anderss. are large and handsome trees; Betula and Acer with nine species each come next, followed by Quercus and Cornus each with six species and Ulmus with five. The Birches, except the shrubby *Betula fruticosa* Pall. and *B. chinensis* Maxim. which is always a small tree, are handsome and grow to a good size. The most remarkable is *B. Schmidtii* Regel, which has hard, close-grained wood, heavier than water, and much exported to Manchuria and China for making axletrees and felloes of carts. This species grows on steep, rocky slopes and the trees though not tall have a short,

stout trunk, clothed with thick, dark bark which flakes off, and a broad crown of no particular shape made up of massive branches. Curiously, the wood and bark of the very different *B. chinensis* Maxim. is almost identical with that of *B. Schmidtii* Regel, but the tree is always small and is found in lower altitudes and on any kind of soil. On the Diamond Mts. I saw the best examples of *B. chinensis* Maxim. Of true Maples only *Acer pictum* Thunb. grows to any real size and this calls for no special comment. Another (*A. pseudo-sieboldianum* Kom.) makes a poor looking tree of medium size but is abundant and in autumn its foliage assumes wonderful tints of orange, scarlet, and crimson and is responsible for much of the autumn beauty of forest and wood. In open country and especially by riversides and in swamps *A. ginnala* Maxim. is abundant as bushes or low, shapeless trees. Its leaves have considerable economic value, being gathered in late summer and after sun drying packed in bales and exported to China where blue, black, and khaki color dyes are prepared from them. Of the eight Maples two are Negundos and both make strikingly handsome trees. The oldest known of the two is *A. mandshuricum* Maxim. which grows 80 ft. tall, has a shapely crown and a straight trunk clothed with firm, pale gray, slightly fissured bark. The other, *A. triflorum* Kom., is of much the same size, has thicker branches and a thin, papery gray-brown bark which shreds off. The autumn tints of both are yellow, orange, and salmon, and singularly beautiful. Of the Oaks *Q. mongolica* Fisch. is the best and its wood the most valuable and when the soil is good, as on Nemonrei in the Diamond Mts., makes a fine tree in habit and size resembling the White Oak (*Q. alba* L.) of eastern North America. As usually seen, however, in Korea the Mongolian Oak is not attractive, being of moderate size only and frequently stagheaded. The less abundant *Q. glandulifera* Bl. is usually a better looking tree, and in the autumn its ruddy tinted foliage renders it most conspicuous. Of the Cornels besides the well known *Cornus kousa* Buerg. and *C. controversa* Hemsl., both strikingly beautiful in summer when in full flower, the less known *C. coreana* Wanger. deserves mention if only on account of its bark which on adult trees is almost black, and deeply fissured into tiny squares like that of *Diospyros virginiana* L. The Korean Cornel grows 60 ft. high and has a trunk from 4 to 5 ft. in girth; the leaves are opposite, but the flowers and fruit are similar to those of *C. controversa* Hemsl. It is interesting to note that the old *C. officinalis* S. & Z., long known as a cultivated tree in Japan, is endemic in Korea where it is a tree often 35 ft. tall with a trunk from 4 to 5 ft. in girth and thin pale gray bark which scales off in loose papery sheets. The common Elm is *Ulmus japonica* Sarg. but nowhere did I see large trees of this species such as are common in Hokkaido; indeed, the largest Elm in Korea is *U. pumila* L. which in the valleys of the north is often 80 ft. tall and has a trunk as much as 12 ft. in girth.

Trees with conspicuous flowers and striking objects in the landscape are *Prunus mandschurica* Koehne, distinguished among Apricots by its large size and by its thick, corky black bark which is red beneath, a Cherry

(*Prunus serrulata* var. *pubescens* Wils.), Wild Pear (*Pyrus ussuriensis* Maxim.), Crab Apple (*Malus baccata* var. *mandshurica* Schneid.), Tree Lilac (*Syringa amurensis* Rupr.), *Maackia amurensis* Rupr. & Maxim. and *Aralia chinensis* L., *Acanthopanax ricinifolius* Seem. and the two Lindens *Tilia amurensis* Rupr. and *T. mandshurica* Rupr. & Maxim. The above trees all grow in plenty and when in flower their effect on the landscape can easily be imagined. The Pear in particular is noteworthy as being the most cold-resisting of Asiatic species and as growing to a larger size than any other — trees from 60 to 75 ft. with crowns as much in diameter and trunks from 10 to 14 ft. in girth are not uncommon. It is widespread in Korea and is frequently found in the forest depths though more usually by the side of streams and on the edge of the forest. The fruit, which is depressed-globose and from one third to half an inch in diameter, may be ruddy or green and with or without the remains of the calyx; the leaves, which vary in shape and serration, assume rich bronze and purple tints in autumn. Cultivated forms of this species are grown in gardens in Korea, Manchuria and north China and yield palatable fruit of good size. The Crab Apple is a tree of moderate size and its wealth of white blossoms in spring is followed by an abundance of small, greenish red to scarlet fruits. It loves a cool soil and is particularly happy in thickets on the banks of mountain streams.

As in other boreal floras conifers are abundant. Besides the Red Pine (*Pinus densiflora* S. & Z.), whose prominence has already been alluded to, the Korean Nut Pine (*P. koraiensis* S. & Z.) is a very common tree on the mountains, and the Creeping Pine (*P. pumila* Regel) clothes the upper slopes and summits of most of the higher peaks from Kangaku-san, about Lat. 38° 30′ N., northward except that of Paiktu-san itself from which it is entirely absent. Two Firs (*Abies holophylla* Maxim. and *A. nephrolepis* Maxim.) are both plentiful, the first-named being indigenous and confined to the low-levels and the other the mountain species. A third species restricted to Quelpaert and Chiri-san has been referred to already. A flat-leaf Spruce (*Picea jezoënsis* Carr.) and another with four-angled leaves (*P. Koyamai* Shiras.) grow in Korea. The latter is confined to the north and more especially the northeast but the flat-leaf species grows as far south as Chiri-san. An unnamed species of Thuja is common on high, non-volcanic mountains from the Diamond Mts. northward; in the forest it is a sturdy shrub or even a small tree often 30 ft. tall but on high treeless slopes it is an undergrowth to *Pinus pumila* Regel. One Juniper (*Juniperus rigida* S. & Z.) is very common, more especially in open country and thin woods of Red Pine or Oak; another (*J. communis* var. *montana* Ait.), grows only in the north, whilst a third (*J. chinensis* var. *Sargentii* Henry), is confined to rocky places high up on the mountains but is distributed from the extreme north to Quelpaert where it grows on Hallai-san at 1600 m. and upwards. To complete the list of conifers indigenous on the peninsula it remains to mention a Larch (*Larix dahurica* var. *Principis-Rupprechtii* Rehd. & Wils.) which covers much of the volcanic area

of the north and is not found elsewhere. This Larch with the two Spruces, the Nut Pine, and the Mountain Fir either grow together or form more or less pure forests and the wood of one and all is of good quality. The other Fir (*Abies holophylla* Maxim.) is of little value as a timber tree but for garden purposes it ranks with the Japanese *A. homolepis* S. & Z. as the best of the Asiatic species. The branches are moderately stout, spreading or ascending-spreading and crowded with dark green leaves. Trees 100 ft. tall with trunks 12 ft. in girth are not uncommon in fairly open country where the soil is rich and moist.

Of Taxaceae only *Cephalotaxus drupacea* S. & Z. and *Taxus cuspidata* S. & Z. grow on the mainland of Korea. The Cephalotaxus as a small shrub of no particular shape is scattered here and there from the vicinity of Keijyo, the capital, southward; the Yew is much more widely spread, growing as far north as the upper waters of the Yalu River. It is not a common tree, though on the Nemonrei, in the Diamond Mts., it is more plentiful and of greater size than I have seen it anywhere else in the Japanese empire.

At this point it seems opportune to say a little about the natural rotation of forests, or, the succession of forest growth as it may be termed — a subject little understood but clearly demonstrated in and by the virgin forests of north Korea. To appreciate this succession and to properly understand what follows, it is necessary to state that in the temperate regions of northeast Asia (and probably everywhere in the world) there are aggressive northern and southern types that are ever extending their geographical range at the expense of (a) types already in occupation of intervening regions, (b) those that flourish under peculiar conditions only, (c) themselves finally. Of these aggressive northern types in Korea may be mentioned Aspen (*Populus tremula* var. *Davidiana Schneid.*), Alder (*Alnus hirsuta* Turcz.), Birches (*Betula davurica* Pall., *B. Ermanii* Cham., *B. japonica* Sieb.), Creeping Pine (*Pinus pumila* Regel), Fir (*Abies nephrolepis* Maxim.), two Spruces (*Picea jezoënsis* Carr., *P. Koyamai* Shiras.). Of southern aggressive trees Red Pine (*Pinus densiflora* S. & Z.), Oaks (*Quercus mongolica* Fisch., *Q. dentata* Thunb., *Q. glandulifera* Bl.), Hornbeam (*Carpinus laxiflora* Bl., *C. cordata* Bl.), Ash (*Fraxinus rhyncophylla* Hance, *F. mandshurica* Rupr.) may be instanced; of types in possession, that is species endemic or nearly so, Fir (*Abies holophylla* Maxim.), Nut Pine (*Pinus koraiensis* S. & Z.) Birch (*Betula Schmidtii* Regel), Maple (*Acer pseudo-sieboldianum* Kom.), Box-elder (*Acer triflorum* Kom., *A. manshuricum* Maxim.), Wild Pear (*Pyrus ussuriensis* Maxim.), Apricot (*Prunus mandschurica* Koehne) may serve as examples.

After forest fires or deforestation by man Birch, usually *Betula davurica* Pall. or *B. Ermanii* Cham. less commonly *B. japonica* Sieb., is the first tree to appear in almost any part of Korea. In the south and at low altitudes and to a less degree in central Korea the Birch may be forestalled by coarse grasses (*Miscanthus* spp. and allies) and natural reafforestation long retarded, but normally, Birch is soon joined by other broad-leafed deciduous trees and

frequently by Red Pine and Fir (*Abies holophylla* Maxim.) and in the course of time develops into pure broad-leaf forest, mixed forest or pure Pine-forest according to the type which becomes dominant. On the east side of the Diamond Mts. where man has much thinned the former pure forest of Red Pine, broad-leaf trees are rapidly changing the whole character of the forest. On the west side of the same mountains, especially round the monastery of Choanji, the broad-leaf forests are being displaced by Nut Pine and Fir. In central Korea and northward coarse grasses are less aggressive and Birch is associated with Aspen in increasing quantity until the volcanic areas of the Paiktu region are reached where Larch becomes a prominent companion of the Birch and Aspen. It is in this Paiktusan region that the succession of forest types is most clearly shown. The cycle is roughly as follows: In the course of time after volcanic activity in that region had ceased, as after forest fires at the present time, seedlings of Birch, Aspen and Larch sprang up from seeds transported from the north by wind. Then, as now, the three kinds of trees grew well together for a few years, the Birch and Aspen the faster at the commencement, but the Larch, though it needs when young a certain amount of shade just such as the twiggy branches of Birch and Aspen afford, is a light-demanding tree and after twenty or thirty years it outstrips its fellows in pace of growth, finally kills them and pure forests of Larch remain. Such forests are thin, open and park-like in aspect and the trees almost of the same age, for no Larch seedlings will vegetate in such forests except by the side of well-tramped paths, or on fallen, rotting trunks, but where fire breaks through they thrive exceedingly. As the Larch-trees increase in size, so the forest floor beneath becomes more and more shady and invites the presence of more shade-loving trees such as Fir and Spruce. When the Larch is from sixty to one hundred years old seedlings of these Fir and Spruce establish themselves, in the course of time grow into trees and finally kill out the Larch to form pure forests of themselves. Like the Larch the trees are of about the same age, for in such forests seedlings do not vegetate under the dense shade of the parent trees either because the shade is too great, because there is too much humic acid in the soil from the constant accumulation of rotting vegetation, or, because of both. On the edges of these forests, in glades, or on fallen rotting trunks only are young seedlings of Spruce and Fir to be found.

Larch with its deciduous leaves, and trunks clear of branches for a considerable distance from the ground, is in much less danger from fire than Fir and Spruce which are evergreen, keep their branches from near the ground upward and, moreover, have a very resinous bark and resinous leaves. However, sooner or later, either from electrical storms or through human agency, fire sweeps through the forests and the cycle is repeated.

The Fir (*Abies holophylla* Maxim.) and the Nut Pine (*Pinus koraiensis* S. & Z.) nowhere in Korea, to-day, form pure forests. Both are associated with broad-leaf trees and the conifers mentioned above. They love rich, cool soils and in the extreme north of Korea there are limited areas of forest fifty per cent pure Nut Pine.

The Larch forests being of open character are easy to traverse and have quite a rich undergrowth of shrubs among which Birch (*Betula fruticosa* Pall.), Blueberry (*Vaccinium uliginosum* L.) and *Ledum palustre* L. in many forms are prominent. The Fir- and Spruce-forests are less rich in woody undergrowth and those of pure Red Pine have none at all. The broad-leaf forests on the other hand are rich in shrubs and climbers of an ornamental character, though those reach their greatest exuberance where trees are fewest. Most abundant are Azaleas, Roses, Magnolias, Honeysuckles, Lilacs, Mock Orange, Deutzia, Forsythia, Spiraea, Indigofera, Symplocos, Viburnum, Berberis, and the climbers Actinidia, Celastrus, Pueraria, Smilax, and Vitis, whilst in central and south Korea on boulders, cliffs, walls, ramparts, and trunks of forest trees the familiar "Ampelopsis Veitchii" (*Parthenocissus tricuspidata* Planch.) luxuriates. In the rocky beds of summer torrents and on the banks of streams the Gray Willow (*Salix gracilistyla* Miq.) is superabundant. The tops of the higher mountains in north Korea are clothed with such alpine shrubs as Creeping Pine (*Pinus pumila* Regel), dwarf Junipers (*Juniperus chinensis* var. *Sargentii* Henry, *J. communis* var. *montana* Aiton), an unnamed Thuja, dwarf Willows in variety, Cowberry and other Vacciniums, the red fruited variety of Arctous (*Arctous alpinus* var. *ruber* Rehd. & Wils.), Crowberry, Dryas, and Rhododendrons such as *Rhododendron chrysanthum* Pall., *R. parvifolium* Adams and allied species. On the barest and most rocky hills and mountains slopes a few woody plants may be found. In spring, late May and early June according to latitude, the whole countryside is gaily decked with flowers. The Wild Pear, Crab Apple, Wild Cherry, Apricot, and other flowering trees which enliven the glades, edge of the forest, river bank, and open country must not be forgotten in this attempt to visualize Korea in spring, nor, the young unfolding leaves of the forest trees from the pure green of the Larch through the grays of some Oaks to the ruddy tints of other species of Oak and Maple. The undergrowth in the woods and the shrubberies when the trees have been destroyed are splashed with masses of white, yellow, pink, rose and purple. Not even in the richest parts of China or Japan have I seen such extensive displays of pure pink and white as on the Diamond Mts. where *Rhododendron Schlippenbachii* Maxim. and *Magnolia parviflora* S. & Z. dominate the undergrowth for many square miles and bloom to perfection.

On the bare hillsides and mountain slopes of central Korea — round Keijyo, the capital, for example — a Forsythia is plentiful and its yellow bells in spring are conspicuous. On the mudshales and limestone a little to the northwest of Keijyo grows a Lilac (*Syringa dilatata* Nakai) which opens its panicles of palest lilac tinted flowers early in spring. It is a bush of good habit often twelve feet high and nearly as much broad with dark green leathery foliage which colors finely in autumn. Examples two feet high bear flowers. In the woods and thickets grow two other species of Lilac and these produce their nearly white to ruddy purple flowers in early summer and the fragrance of one of them (*Syringa Palibiniana* Nakai) is

delightful. In early summer too a lovely Weigelia (*Diervilla florida* var. *venusta* Rehd.) and the Rose Indigofera (*Indigofera Kirilowii* Maxim.) are clothed with their attractive flowers and since the plants are plentiful the display is conspicuous. Very plentiful in open country and thin woods is that harbinger of spring *Rhododendron mucronulatum* Turcz. and so too is the less well-known *R. poukhanense* Lév. which with its compact, twiggy growth and wealth of fragrant, rosy-mauve colored flowers is a feature of the countryside in late April and May from Quelpaert northward to the latitude of Pingyang. On rocky, grass-clad slopes it covers areas which on the foothills of Chiri-san are acres in extent; on Quelpaert it grows in great plenty from sea-level to the summit of Hallai-san (alt. 1952 m.). The white-flowered Rambler Rose (*Rosa multiflora* Thunb.) and its more northern and handsomer relative *R. Jackii* Rehd., are also among the features of the early summer flora of Korea.

Since Pine and Fir are the dominant trees in the landscape over much of Korea the flowering shrubs and trees are well provided with a setting which enhances their beauty whether it be the flowers in spring and summer or the tinted foliage in autumn. Often in thin woods of Red Pine the undergrowth is almost entirely of pink, rose, or rosy-mauve Azaleas and the rose-colored Indigofera and such places are perfect gardens.

In species of climbing plants Korea is poor and it boasts no Wistaria nor anything approximating in beauty. However, climbing plants are plentiful if not varied, and in autumn the tints of Veitch's Ampelopsis and of the Amur Grape (*Vitis amurensis* Rupr.) are not exceeded in brilliancy anywhere. In early summer two Actinidias (*Actinidia kolomikta* Maxim., *A. polygama* Maxim.) with fragrant, white flowers in clusters hidden beneath the leaves, a great many of which are pure white or half white and half green, are striking objects on the mountain slopes. The white leaves change to pink and rose as the flowering period passes. In summer the most noteworthy climber is *Tripterygium Regelii* Sprague & Takeda, with its bright brown, lenticellate branches, large panicles of pure white flowers which are followed by white changing to pink, bladder-like fruits. It is abundant, sprawling over shrubs and small trees and sometimes over larger trees fifty feet and more tall.

Korea from early times has been the highway over which many Chinese plants of economic value and of ornamental character have travelled to Japan. For example: — Chinese Persimmon (*Diospyros kaki* L.), Sand Pear (*Pyrus serotina* var. *culta* Rehd.), Korean Apple (at present called *Malus asiatica* Nakai), Japanese Plum (*Prunus salicina* Lindl.), Bush-cherry (*P. tomentosa* Thunb.), Varnish Tree (*Rhus verniciflua* Stokes), Moutan Paeony (*Paeonia suffruticosa* Andrews), the Paulownia (*Paulownia tomentosa* K. Koch) and others, all indigenous in China, reached Japan by way of Korea. Likewise certain Korean plants were long ago introduced to Japan and reached Europe and America from there at a later date. Among older examples may be instanced *Pinus koraiensis* S. & Z., *Cornus officinalis* S. & Z., and *Diervilla florida* S. & Z.; in more recent times *Rhodo-*

*dendron Schlippenbachii* Maxim. and *Viburnum Carlesii* Hemsl. The last named, probably the best known and most popular of Korean shrubs, was introduced from Japan into England in 1902.

By roundabout ways plants from China have, intermittently, found their way to western lands from the 16th cent. if not earlier, and from Japan since the 17th cent., though in each case often with long breaks in the periods. Yet, the 20th cent. had almost dawned before any seeds or living plants direct from Korea reached the Occident. In 1897, a Russian Botanist, Vladimir L. Komarov, made a trip through north Korea, collected herbarium material and probably some seeds, for in the *Gardener's Chronicle* (ser. 3, XLIV, 210 [1908]), there is a figure, and note about *Rodgersia tabularis* Kom., a typical Korean herbaceous plant, flowering in Kew gardens from seeds received from the Imperial Botanic Garden, Petrograd, in 1905. In December, 1904, the Arnold Arboretum received, through the Imperial Botanic Gardens, Tokyo, some seeds collected in Korea by T. Uchiyama which resulted in the introduction of *Abies holophylla* Maxim. and *Hemiptelea Davidii* Planch. In 1905, Mr. J. G. Jack, of the Arnold Arboretum staff, was in the Orient and visited Korea. The Russo-Japanese war was still in progress and it was impossible for any one to travel freely in Korea. Moreover, Mr. Jack's main purpose was not botanical collecting, nevertheless he sent back to this institution seeds and living material of quite a number of plants which have proved to be of exceptional interest and value. To Mr. Jack we owe such Korean plants of merit and hardiness as *Rhododendron poukhanense* Lév., *Diervilla florida* var. *venusta* Rehd., *Tripterygium Regelii* Sprague & Takeda, *Malus baccata* f. *Jackii* Rehd., *Rosa Jackii* Rehd., *Evodia Daniellii* Hemsl., an Oak (*Quercus aliena* Bl.) and the plants in this Arboretum of the lovely *Indigofera Kirilowii* Maxim. This list makes no pretense of being complete but their value was a sufficient incentive to further work in Korea and culminated in the Expedition, undertaken by the Arnold Arboretum, which lasted from 1917 to February, 1919. Among other things this expedition secured seeds and living plants of about two hundred species and varieties of woody plants. Of the behavior of these here it is too early to write and it would be unwise to enlarge upon their qualities. As they grow in Korea many are decidedly handsome and we may hope that they will successfully adapt themselves to the climates and soils of western lands.

Compared with the floras of China and of Japan that of Korea is a fairly simple study but it cannot be properly understood unless its relationship with that of contiguous and adjacent regions be given due consideration. It is not without its own peculiar problems and contains much of interest to the botanist and gardener.

# NEW SPECIES, VARIETIES AND COMBINATIONS FROM THE HERBARIUM AND THE COLLECTIONS OF THE ARNOLD ARBORETUM

ALFRED REHDER

THE purpose of this paper is to publish a number of new combinations, new species, new varieties and forms, as well as to record various observations which have presented themselves in the course of a systematic rearrangement of the herbarium of the Arnold Arboretum and while working on a manual of cultivated trees and shrubs. Particularly the application of the International Rules of nomenclature to the material preserved in our herbarium has made new combinations necessary, and a few words therefore may be said of the principles guiding these nomenclatorial changes.

The interpretation of certain articles of the International Rules has been always subject to a diversity of opinion, due chiefly to more or less vagueness in the wording of these articles and to the introduction into the rules of the type method, to which nearly all American botanists now adhere and which apparently is gaining more and more foothold abroad, as shown by the additional recommendation, XVIIIbis, in the revised code which reads: "When publishing names of new groups to indicate carefully the subdivision which is regarded as the type of the group: the typical genus in a family, the typical species in a genus, the typical variety or specimen in a species." One of the most important consequences of the acceptance of the type method is a different attitude in regard to articles 45 and 47 dealing with the division of groups.

It is not the place here to enter into a discussion as to how to determine the type of genera and species and it is, moreover, hardly possible to formulate general rules for the determination of types, as each case must be considered and judged on its own merits, but it may safely be stated that the number of cases where one cannot reach a conclusive decision is comparatively small. The difficulty lies chiefly with those who consider a group to be a conception, that is, a genus a group of species, and a species a group of individuals or minor forms joined together by common characters and circumscribed by a description, instead of taking the position that the groups or individuals are assembled around a group or an individual which is considered the typical representative; however much or however little a group is changed by additions or subtractions, it always keeps the same name with the citation of its original author as long as it contains the typical form. Those who view a group as a conception are easily led to abandon a specific name on the plea that it is composed of different elements, if it contains forms which according to our present point of view represent different species, or in the case of a genus to resort to counting the number of species and leaving the name with the largest number. There is, no doubt, great difficulty in determining the generic type in some of the old Linnaean genera like Sorbus, Crataegus, Prunus, and for such cases the doctrine of

residues may perhaps be put into practice. The method of taking the first species in a genus or the first citation or synonym in a species is an artificial makeshift and not to be recommended. In genera to make the selection of the type dependent, as recommended in the examples under art. 45, on subsequent publications where the original extent and circumscription of the genus often is considerably altered, is certainly against the principle of priority, and as it thus violates one of the fundamental principles of the Code, we may consider ourselves justified in disregarding this recommendation. There will be, of course, cases when the type method will result in displacing generally accepted names, or cause considerable inconvenience, but this is unavoidable, if one follows consistently any set of rules. In the case of a generic name it may be saved by including it under the nomina conservanda, and in a case like Ulmus campestris the name may be rejected by taking recourse to art. 51, 4 of the rules.

Another source of different opinions is article 50, arising chiefly from the fact that no distinction is made between valid names and valid taxonomic groups, that is between nomenclatorial and taxonomic validity. The wording of the rule: " No one is authorized to reject, change or modify a name . . . because of the existence of an earlier homonym which is universally regarded as non-valid," is unfortunate. The phrase " universally regarded as non-valid " seems contradictory in itself, for a name is either valid or non-valid, depending on whether it is formed according to the rules or not, and it cannot be made so by general consent. This becomes clear by the revised article 56 which reads in part: " By valid name is implied a name and especially a combination of names formed in accordance with the rules of nomenclature." The strict adherence to this ruling will exclude a considerable number of homonyms which otherwise tend to make nomenclature unstable. As names that have become synonyms by change of generic or specific limitations may be revived at any time by another change in the taxonomic valuation of genera or species, I have termed non-valid names unconditional synonyms, and synonyms for taxonomic reasons conditional synonyms (see Rhodora XVII. 61, footnote). As an example, *Picea canadensis* (Mill.) Britton, Sterns & Poggenburg, may be cited. This name cannot stand on account of the older *P. canadensis* (L) Link which is the correct name of the Hemlock Spruce under the genus Picea. Even if Tsuga is now recognized as a distinct genus by almost all botanists and therefore *Picea canadensis* Link referred to *Tsuga canadensis* as a synonym, this should not make any difference, since at any time botanists may unite *Picea* and *Tsuga* again and thereby cause *P. canadensis* Link to be revived. A similar case is *Malus floribunda* Sieb., which if transferred to Pyrus should be changed to *P. pulcherrima* Ascherson & Graebner and not be called *P. floribunda* Voss, on account of the older homonym *P. floribunda* Lindley, even though according to the author's view that species belongs to Sorbus or Aronia, but as there are botanists who unite Pyrus, Malus, Sorbus and Aronia, and others who unite Malus and Pyrus and keep Sorbus distinct, *Pyrus floribunda* Voss would under certain generic limitations keep its

name, while under different generic limitations the name had to be changed to *P. pulcherrima*, if no distinction is made between taxonomic and nomenclatorial synonyms. As an example concerning specific names within the same genus, *Rosa microphylla* Roxburgh (1820), may be quoted; this name cannot be maintained, as there is an older *R. microphylla* Desfontaines (1798) which, though generally referred as a synonym to *R. sempervirens* L., does not represent the type of that species and therefore may be revived by an author favoring narrower specific limits. On the other hand, a name like *Quercus lanuginosa* Thuillier (1799) is to be considered valid, though there is an older *Q. lanuginosa* Lamarck (1778) which, however, is not valid, as it is a nomenclatorial synonym of *Q. Cerris* L. (1753) being based on that species.

One of the most difficult problems is the nomenclature of varieties and other subdivisions of species. Many botanists consider the different grades of subdivision of species as subject to the rules governing the change of rank, while others preserve even the original author citation when changing a variety to a form or vice versa. One of the chief objections against the former practice is the lack of restriction placed on the number of subdivisions, for according to art. 12 one is allowed to intercalate as many supplementary groups as one sees fit, and the absence in many cases of the exact designation of the nature of the different grades, which often are preceded only by letters, numerals or typographical signs, or are joined directly to the specific name (so-called trinomials). Even if such terms as variety or form are used, they are frequently employed in a vague sense and may have different value in different publications. It is difficult to see how we can apply to subdivisions whose grade is not clearly defined the strict rules governing change of rank without introducing many unnecessary changes on account of different opinions on the valuation of certain names. The possibility also is thereby given to change at will almost any name of a subdivision by changing the designation of the grade, e. g. by calling a form a lusus, a subvariety a form, a variety a subspecies; though such changes are against the recommendations, they are not against the rules, and once made, whether intentionally or inadvertently, they cannot be revoked.

To make the nomenclature of varieties as stable and simple as possible, it seems best to consider as groups of different rank only those restricted to definite numbers, that is the main groups as enumerated in article 10 and their subdivisions as given in article 11, counting the subdivisions of each main group as one unit, that is as one rank, while the different kinds of subdivisions as admitted by art. 12 which are of an indefinite number, may be considered grades or degrees of subdivision. Regarding the question whether the different subdivisions of species should be considered ranks, it seems significant that among the numerous examples illustrating change of rank, none is given which illustrates the change of any grade of subdivision to another grade of subdivision of the same species. It also is to be noted that apparently subdivisions of a genus, as subgenus and section, are not considered as constituting different ranks, as shown by the first example

under art. 48: "The subgenus Alfredia Less. of the genus Rhaponticum keeps its name when placed in the genus Carduus: Carduus sect. Alfredia Benth. & Hook. f."

I am therefore inclined to maintain in every case the oldest name regardless of change of grade or so-called rank. The name of the author, however, should be changed with a change in the grade, if the nature of the grade is clearly defined in both instances; if the original author failed to designate the grade, the fixation of the grade is an emendation and the name of the original author should be kept. If a combination is used as a trinomial the author of the original combination should be quoted regardless of any later change of grade.

To designate a certain subdivision of a species it is only necessary to add the name of this subdivision to the binomial, omitting the names of any higher grades which may have been placed between this particular subdivision and the specific name. A combination of three names should always be sufficient to designate any group below the species. This, of course, does not apply to exact taxonomic work where names and combinations should be cited exactly as published by their author.

As to precise citation, I want to draw attention to the fact, that in most publications names published as synonyms are cited as if published as valid names; it seems advisable to add in such cases always after the citation the words "as a synonym" or "pro synon." and in exact citation also the name of the group under which the name in question is placed as a synonym. Likewise should the fact that a name has been published without description or reference to a previous description, and therefore not valid, be brought out by the addition of the words "nomen" or "nomen nudum," or of "nomen seminudum," if an insufficient reference, perhaps a reference to an illustration without description, is given.

When it seems desirable to abbreviate citations as much as possible, one may restrict the author citation in cases where two authors (the author of the manuscript name and the publishing author) are given to the name of the publishing author; this is particularly important in names cited as "Hort."; e. g. *Gesnera Donklarii* Hort. apud Hook. should be abbreviated *G. Donklarii* Hook. The citation "Hort." alone is almost meaningless, as it not infrequently happens that the same name has been used for different plants in different gardens and as this citation does not give the slightest hint when and where such a name may have started. The author who first publishes such a name with a description makes the name valid and is really the author of the name from a nomenclatorial point of view.

At this institution we have to deal to a great extent with forms of cultivated plants and their nomenclature presents some additional difficulties which cannot be entirely solved with the help of the International Rules of botanical nomenclature. We have therefore to take into consideration the rules accepted by the International Congress of Horticulture at Brussels in 1910. These rules were originally published in Bull. Soc. Bot. Belg. XLVII. 419–424, preceded by a detailed preliminary report (pp. 363–419); an Eng-

lish version preceded by the preliminary report of the Royal Hort. Society only appeared later in Jour. Roy. Hort. Soc. XXXVII. 149–151 from which we quote.

According to article I. horticultural nomenclature is based upon the rules of botanical nomenclature as adopted by the International Congress of Botany held at Vienna in 1905, with some modifications, however, which concern the nomenclature of varieties and hybrids.

Art. II. dealing with the naming of horticultural varieties reads: "It is necessary in naming horticultural varieties of species and simple forms to employ the complete names of the species with the name of the author. The employment of Latin in naming horticultural varieties is authorized only when the character of the plants is expressed, e. g., nanus, fastigiatus, etc. The use of Latin proper names for such varieties is proscribed.

"The names of horticultural varieties must always be written in Roman characters. [E. g. *Alyssum maritimum compactum*, *Pelargonium zonale* 'Mrs. Pollock.']"

Before accepting the ruling of this article we have to answer the question what constitutes a horticultural variety or form, as neither the rules of botanical nor of horticultural nomenclature give a definition of this term.

Can we really make a distinction between a horticultural and a botanical form? Is there any inherent difference between a mutation which has sprung up in the field or forest and has by a lucky chance survived, and a mutation which has sprung up in the seed-bed of the nursery and saved by man's interference? A large number of so-called garden forms have originated spontaneously as is well known and afterwards transferred to the garden and propagated. Is e.g. *Ilex opaca* f. *xanthocarpa* Rehder, because it was found wild and named before it was introduced into cultivation, a botanical form, and *Ilex Aquifolium* f. *chrysocarpa* Zabel a horticultural form, because it originated in cultivation and was named from a cultivated plant? I think one can but answer no.

It therefore appears that the difference is not in the plant, but in the name or in the rules governing the name, whether one applies the name from a botanical point of view considering the form a group of similar individuals whose taxonomic limits one can modify without change of name, while a horticultural form applies to an individual or its equivalent. This named individual is usually perpetuated by vegetative propagation, or if propagated by seeds only the individuals which reproduce the parent exactly are considered as belonging to the named form in question, while every slight deviation is a "rogue" which is either disregarded or destroyed, or if possessing special horticultural merits, given another name and made the starting point of a new form. It is therefore only fitting that such individuals should bear vernacular names, which may be compared to the names of human individuals, while on the other hand we are justified in treating every form which bears a name indistinguishable from a so-called botanical name, according to the rules of botanical nomenclature, that is as a group which may include besides the typical individual other closely re-

lated individuals showing slight variations but possessing the chief characters of the form in question. This is probably the idea underlying the rule that Latin names like " nanus, fastigiatus " are allowed, while proper Latin names are proscribed, because the framers of that rule, though not clearly stating it, apparently considered these Latin names to be group names.

Horticulturists therefore should use names differing in form from botanical names, if they desire to have the name stand for exactly the plant they intend to name. This agrees with the way plant breeders generally look on the named forms they distribute and the practice is well adapted for the purpose it serves and should not be interfered with. A horticultural name lapses when the plant disappears from cultivation, while a botanical name remains still valid in such a case and should be used again, if at any time a form appears answering to the description of the original form.

A name like *Thuja occidentalis* f. *aurea* Nicholson may be applied to different yellow-leaved forms differing in the shade of yellow and perhaps slightly in other characters, but a name like " Meehan's Golden " stands for an individual form and for its vegetative progeny; if this plant had been named " Meehanii " one would be justified in treating it as a botanical name and make it a synonym of *T. occidentalis aurea*, or if that latter name did not exist, make it the type of a group of yellow-leaved forms in which it would lose its individuality.

In some instances names of new horticultural forms have been published consisting of two not connected Latin words, e. g. *Chamaecyparis pisifera* var. *plumosa aurea*; this name stands for a form which is different from *C. pisifera plumosa* and also from *C. pisifera aurea*. According to the rules of botanical nomenclature a varietal name can be used only once under the same species, while according to the rules of horticultural nomenclature varietal names consisting of two or three words are allowed, though one is probably correct in assuming that this rule really is intended for names in the vulgar tongue like " Madame Casimir Perier " or " Mrs. Pollock." If we consider " plumosa aurea " a horticultural name, it can be used, but may be written *C. pisifera* plumosa aurea or C. pisifera " plumosa aurea " to bring out the fact by the difference in type or by the quotation marks that the varietal name is not a part of the botanical name. If, however, " plumosa aurea " is considered a botanical name, it must be changed, as it is contrary to the rules of botanical nomenclature, and a new name chosen, consisting of a single word. It seems rather doubtful if it is advisable to coin new names for all cases where the name of a horticultural variety consists of two or more words, and therefore, it is probably better to leave and use these names as they are, indicating only by the manner of writing and quoting them, that they are not part of the botanical name and that the whole name is not a combination in the nomenclatorial sense of the term.

Of the modifications concerning hybrids, the most important adopted by the Horticultural Congress is contained in art. XIII. which reads: " Bigeneric hybrids are also designated by a name and a formula. The generic name is formed by the combination of the generic names of the parents. . . . —

Multigeneric names known so far only in Orchids also receive distinct generic names according to article XIV.

The International Rules of botanical nomenclature do not favor the coining of new names for intergeneric hybrids. Art. 32 rules that the intergeneric hybrid is associated with the one of the two genera which precedes the other in alphabetical order. Against this ruling the following objections can be raised: 1° that such names give by their form, if used without their formula, not the slightest hint that the hybrid is an intergeneric hybrid, as it may as well be taken for a hybrid between two species of the same genus — 2° that it seems logical that a hybrid between two genera receives a distinct generic name, as long as a hybrid between two species of the same genus receives a distinct specific name — 3° that the insertion of an intergeneric hybrid under one of the parent genera would necessitate a change in the characters of the genus under which it is placed — 4° that the giving of new generic names to intergeneric hybrids is according to general usage, as almost every one of these hybrids has received a generic name.

A modification concerning specific names of hybrids is contained in art. VIII. which reads: "The specific name of a hybrid may be expressed in Latin or in any language that is written in Roman characters." This partly contradicts art. 31. of the Rules of botanical nomenclature which reads: "Hybrids between species of the same genus or presumably so, are designated by a formula and, whenever it seems useful or necessary, by a name. . . . The name which is subject to the same rules as names of species, is distinguished . . . by the sign × before the name." As names in the vulgar tongue are not allowed for names of species, it follows that they should not be used for the specific names of hybrids. In the French preliminary report this question is discussed at length on pp. 389–392 where it is stated that opinions were almost equally divided between those who favored the admission of vernacular names and those who did not, but the opinion of those favoring admission prevailed. As an example × *Cattleya* Princesse Clémentine is cited, which should not have been translated into × *C. Clementinae*, as done by Hurst & Rolfe, but retained in its original form. According to my opinion, however, both names can be used, if the distinction I have made above between botanical and horticultural names of varieties is applied also to hybrids. In this case the vernacular form × *Cattleya* Princesse Clémentine would stand, following horticultural usage, only for the original cross, while × *C. Clementinae*, according to botanical usage, would include, distinguished as varieties if necessary, all later crosses between the same parent species.

However much we may be convinced that by taking into consideration the Latin names of forms of cultivated plants, we shall incur many inconveniences, we cannot avoid it. As shown above, there is no difference between a botanical and a horticultural form, and as long as a horticultural form has received a name indistinguishable from a botanical name, it must be treated according to the rules of botanical nomenclature. Neither is it possible to exclude names published in garden catalogues, nursery price-

lists and the like provided they are accompanied by a sufficient description, since art. 35 says that publication is effected by the sale or public distribution of printed matter or indelible autographs, which does not exclude any class of publication. The only way to exclude such names would be by taking advantage of art. 36 which rules, that after January 1, 1908, the publication of names of new groups will be valid only when they are accompanied by a Latin diagnosis, but this rule is practically a dead letter, and I have as yet no knowledge of any name disregarded for this reason; considered as a recommendation art. 36 is excellent.

## TAXACEAE

**Taxus chinensis** (Pilger), spec. nov.[1] — *Taxus baccata* Franchet in Nouv. Arch. Mus. Paris, ser. 2, VII. 103 (Pl. David. I. 293) (1884), non Linnaeus; in Jour. de Bot. XIII. 264 (1899). — Pritzel in Bot. Jahrb. XXIX. 214 (1900). — Masters in Jour. Linn. Soc. XXIV. 546 (1902); XXXVII. 414 (1906); in Jour. Bot. XLI. 269 (1903).— *Taxus baccata* subsp. 2. *cuspidata* var. *chinensis* Pilger in Engler, Pflanzenr. IV. 5, 112 (Taxac.) (1903). — Patschke in Bot. Jahrb. XLVIII. 630 (1913). — *Taxus baccata* var. *sinensis* Henry in Elwes & Henry, Trees Gt. Brit. Irel. I. 100 (1906).— *Taxus cuspidata* var. *chinensis* Rehder & Wilson in Sargent, Pl. Wilson. II. 8 (1916).

Arbor 5–16-metralis; ramuli annotini et vetustiores plerumque cinereo-brunnei vel flavo-cinerei; gemmae pallide brunneae, perulis obtusiusculis, dorso fere planis v. inferioribus leviter carinatis, basi ramulorum non, vel partim tantum persistentibus. Folia biseriatim expansa, pleraque satis distantia, vix vel raro arcte contigua, falcata, 1.5 – 3 cm. longa, 2.5 – 4 mm. lata, apice plus minusve abrupte mucronulata, mediano supra plerumque leviter elevata, rarius prominente, subtus basi excepta obsoleto. Semen late ovoideum, 6 mm. longum et 5 – 6 mm. crassum, vix compressum, apice leviter bicarinatum, ceterum laeve, hilo fere orbiculari.

China. Western Hupeh: *A. Henry* (No. 6913), *E. H. Wilson* (Arn. Arb. Exped. No. 1265, in part). Eastern Szechuan: *A. Henry* (No. 7097, 7155, type), *E. H. Wilson* (Veitch Exped. No. 624). Western Szechuan: *E. H. Wilson* (Arn. Arb. Exped. No. 1265, in part, No. 4053). Chekiang: *F. N. Meyer*, 1907 (No. 433). Shensi: *W. Purdom*, 1910. Kansu: *F. N. Meyer*, 1914 (No. 1790).

Opinions may differ if it is better to consider the different geographical forms of Taxus distinct species or varieties or subspecies of *T. baccata*, but whatever view is taken, the same rank should be given to the Chinese form as to the other geographical forms, and it should not be made a subdivision of *T. cuspidata*, as it differs from that species as much as the other species differ from each other. Its place seems to be between *T. cuspidata* and *T. Wallichiana* Zuccarini. *Taxus cuspidata* which is its nearest relation differs chiefly in the following characters: Winter-buds with acute, keeled, and rather loosely imbricated scales persistent at the base of the branchlets: leaves straight or nearly straight, generally shorter and very crowded and

[1] *T. chinensis* Roxburgh, Hort. Beng. 73 (1814) is a nomen nudum and therefore not valid; it is considered a synonym of *Podocarpus macrophyllus* Don.

overlapping, usually not distinctly distichous, more abruptly acuminate at the apex, with the midrib prominent above and conspicuous beneath; seed more compressed and with an elliptic hilum.

PINACEAE

**Cupressus lusitanica** Mill. var. **Knightiana,** comb. nov. — *Cupressus Knightiana* Knight & Perry, Syn. Conif. 20 (1850), nom. — Carrière, Traité Conif., ed. 2, 158 (1867). — *Cupressus elegans* Low ex K. Koch, Dendr. II. pt. 2, 156 (1873), pro synon. — *Cupressus Benthamii* var. *Knightiana* Masters in Jour. Linn. Soc. XXXI. 340, f. 15 (1896). — Mottet, Conif. Tax. 92, fig. 10 (1902). — *Cupressus lusitanica* var. *Benthamii* Henry in Elwes & Henry, Trees Gt. Brit. Irel. V. 1177 (1910), pro parte, non Carrière.

This variety differs from the type chiefly in its distinctly pyramidal habit and in its regularly pinnate branchlet-system with the ultimate branchlets of nearly equal length and compressed; the leaves are acuminate and the mucro of the cone-scales large and conical. Henry identifies *C. Knightiana* with his *C. lusitanica* var. *Benthamii*, but the latter differs, as far as I can see, in the tetragonal, not or scarcely compressed, somewhat thicker branchlets, with the ultimate branchlets though likewise disposed in one plane less regular and not of almost equal length. The color of the leaves varies in both varieties from green to glaucous.

**Chamaecyparis obtusa** f. **tetragona,** comb. nov. *Retinispora tetragona aurea* Barron, Select. Cat. Conif. (opp. p. 12) (1875). — *Chamaecyparis obtusa tetragona aurea* Nicholson, Dict. Gard. I. 304 (1884–85). — *Cupressus obtusa tetragona-aurea* Masters in Jour. Linn. Soc. XXXI. 355 (1896).

The varietal name " aurea " is preoccupied by *C. obtusa aurea* Fortune apud Henckel & Hochstetter and as no other form named " tetragona " is known, this name should be used for the form under consideration.

× **Larix Henryana,** nom. nov. (*L. decidua* × *Kaempferi*). —*Larix ? europaea* × *leptolepis* Henry in Elwes & Henry II. 388 (1907). — *Larix hybrida* Farquhar, Cat. New Rare Pl. 7 (1916), nomen. — Rehder in Bailey, Stand. Cycl. Hort. VI. 3569 (1917).

Young branchlets yellowish, slightly bloomy; branchlets of the previous season yellow or grayish yellow, lustrous; bud-scales at the base of the shoots with scattered hairs inside; terminal buds conic-ovoid, red-brown, the lowest scales aristate, lateral buds globose-ovoid, obtuse, resinous, buds of spurs ovoid, their outer scales loose, with hairs at the base. Leaves glaucous, those of the spurs 2–5 cm. long, above with 1 or 2 lines of stomata on each side, below with 3–5 lines on each side and keeled; those of the shoots 1.5–2.5 cm. long and about 1.5 mm. broad, acute and mucronate, above with 2–4 lines on each side and below with 5–7 lines on each side, in cross-section compressed-rhombic, with a slightly raised midrib below. Cones not known.

*Larix Kaempferi* Sarg. is chiefly distinguished from the hybrid by the dense glaucous bloom covering the young branchlets and by the reddish color of the branchlets of the previous season, by the longer and broader

leaves, those of the shoots being about 3 cm. long and 1.75 mm. broad, flattened and with a distinctly raised midrib below; both kinds of leaves with more numerous rows of stomata.

*Larix decidua* Miller differs from the hybrid chiefly in the grayish yellow, not glaucous branchlets and the lustrous yellowish branchlets of the previous season, and in the narrower leaves of the shoots, about 1.25 mm. broad and not quite so compressed in the cross-section, the stomatiferous lines above composed of 2–3 lines and of 3–4 lines below, the leaves of the spurs with 1 line on each side above and with 2–3 lines beneath on each side.

This hybrid was first mentioned by A. Henry (l. c.) who states that plants were raised at his suggestion by the late D. Keir, head forester on the Atholl estates, from seeds of a tree of *L. Kaempferi* planted close to a common Larch, at Dunkeld, Scotland, and that Mr. D. Keir's son considers the plants intermediate between the two species.

Plants received from Dunkeld are growing at the Arboretum and form regularly pyramidal vigorous trees of which the tallest is now about 12 feet tall. In general appearance they resemble most *L. Kaempferi* except one plant which approaches somewhat *L. decidua*.

**Pseudolarix amabilis,** n. comb. — *Abies Kaempferi* Lindley in Gard. Chron. 1854, 255, 455, fig.; 1855, 644, fig.; non Lindley in Penny Cycl. I. 34 (1833).[1] — *Larix Kaempferi* Carrière in Fl. des Serr. XI. 97 (1856). — *Pseudolarix Kaempferi* Gordon, Pinet. 292 (1858). — *Larix amabilis* Nelson, Pinac. 84 (1866). — *Pinus Kaempferi* Parlatore in De Candolle, Prodr. XVI. pt. II. 412 (1868), non Lambert. — *Pseudolarix Fortunei* Mayr, Monog. Abiet. Jap. 99 (1890). — *Laricopsis Kaempferi* Kent, Veitch's Man. Conif. 404 (1900).

As the combinations with the specific name " Kaempferi " are based on the non-valid name *Abies Kaempferi* Lindley of 1854, they must be all considered non-valid and the specific name must be replaced by the next oldest which is *Larix amabilis* Nelson. Mayr in giving the new name *P. Fortunei* to this tree was apparently not aware that it had been called *Larix amabilis* in the little known and usually neglected book of J. Nelson.

**Abies homolepis** Sieb. & Zucc. var **tomomi,** var. nov. — *Abies tomomi* Bobbink & Atkins, [Cat.] 13 [1909 ?], sine descriptione.

This forms a slenderer and more sparingly branched tree than the type; the leaves are shorter, about 0.8–1.5 cm., rarely 2 cm. long.

A plant received from Bobbink & Atkins in 1916 is growing in the Arnold Arboretum. I have also seen it growing in the New York Botanic Garden

[1] *Abies Kaempferi* Lindley of 1833 is based on *Pinus Kaempferi* Lambert which is identical with *Abies leptolepis* Sieb. & Zucc. of 1842. As "Kaempferi" is the oldest specific name for this Larch, Sargent was correct in reëstablishing this name; for the older homonym *Larix Kaempferi* Carrière which belongs to *Pseudolarix amabilis* is a non-valid name, as pointed out above, and according to the International Rules it cannot prevent the reëstablishment of the older name. The result would be the same, if one considers *Larix Kaempferi* Carr. and also *Abies Kaempferi* Lindley of 1854 as belonging partly, as to the name-bringing synonym, to the Japanese Larch, and partly, as to the description, to the Chinese Gold-Larch. For a complete enumeration of synonyms of *L. Kaempferi*, the Japanese Larch, see Wilson, Conif. Jap. 30 (1916).

where it was received from Hicks & Son in 1907 and again in 1914 from Bobbink & Atkins. Specimens are preserved of all these plants in the herbarium of the Arnold Arboretum.

× **Abies insignis** Carrière apud Bailly in Rev. Hort. 1890, 230. (*A. Nordmanniana X Pinsapo*). — *A. pseudopinsapo* Carrière in Rev. Hort. 1879, 444, 474, sine descriptione. — *Pinus insignis* Voss in Putlitz & Meyer, Landlex. IV. 774, 775 (1913), non Douglas.

The original plant of this hybird was raised by Renault, Bulgnéville, France, in 1872 from seed of *A. pinsapo* fertilized probably by *A. Nordmanniana refracta* Carr. (see Bailly in Rev. Hort. 1890, 230). Later hybrids of the same parentage were raised and subsequently described under binomial designations. This is not correct according to the International Rules which provide that such forms should be classed under the hybrid first described like subdivisions of a species.

× **A. insignis** var. **speciosa**, comb. nov. — *Abies Nordmanniana* Hort. apud Bailly in Rev. Hort. 1890, 231.

This cross was raised about the same time as the original cross by Croux of Sceaux near Paris from seed of *Abies Nordmanniana* fertilized by *A. pinsapo*.

× **A. insignis** var. **Beissneriana**, comb. nov. — *Abies Beissneriana* Mottet in Rev. Hort. 1902, 163.

This cross was raised like the following three forms by Moser of Versailles in 1878 from seed of *A. pinsapo* fertilized by *A. Nordmanniana*. Mottet's name cannot invalidate the later *A. Beissneriana* Rehder & Wilson, a species of China, as it is a non-valid name, being given to a hybrid which already was provided with a specific name.

× **A. insignis** var. **Kentiana**, comb. nov. — *Abies Kentiana* Mottet. l. c.

× **A. insignis** var. **Andreana**, comb. nov. — *A. Andreana* Mottet, l. c.

× **A. insignis** var. **Mastersiana**, comb. nov. — *A. Mastersiana* Mottet, l. c.

**Abies spectabilis** Spach var. **brevifolia**, comb. nov. — *A. Webbiana* var. *brevifolia* A. Henry in Elwes & Henry, Trees Gt. Brit. IV. 751 (1909).

This according to Henry is the form of the northwestern Himalayas where it grows above *A. pindrow* Spach at elevations of 10–14000 feet. It chiefly differs from the type in its shorter leaves not exceeding 3 cm. in length, grayish beneath with inconspicuous stomatic bands. The tree is in cultivation in England, but the date of its introduction is uncertain; it is certainly hardier than the type.

**Abies alba** Miller, Dict. ed. 8, No. 1 (1768). — Nymann, Consp. Fl. Eur. 673 (1878). — Ascherson & Graebner, Syn. Mitteleur. Fl. I. 191 (1897). — *Pinus Picea* Linnaeus, Spec. II. 1001 (1753). — *Pinus Abies* Duroi, Obs. Bot. 39 (1771). — *Pinus pectinata* Lamarck, Fl. Franç. II. 202 (1778). — *Abies vulgaris* Poiret in Lamarck, Encycl. Méth. VI. 514 (1804). — *Abies pectinata* De Candolle in Lamarck, Fl. Franç. III. 276 (1805). — *Abies Picea* Bluff & Fingerhut, Comp. Fl. Germ. II. 541 (1825), non Miller. — Lindley in Penny Cycl. I. 29 (1833). — *Picea pectinata* Loudon, Arb. Brit. IV. 2329 (1838).

As far as I can see *Abies alba* is the correct name for the European Silver Fir. Though the oldest name for the species is *Pinus Picea* Linnaeus, the combination *Abies Picea* Bluff & Fingerhut cannot be accepted, as there is the older homonym *Abies Picea* Miller which is a valid name being the correct name of the European Spruce under the genus Abies. One may possibly question the validity of Miller's name *Abies Picea*, as the oldest name is *Pinus Abies*, but if that specific name had been used for the combination, it would have been against art. 55, 2° and likewise against the usage of all the older botanists. Therefore it was necessary to select a new specific name. It is certainly unfortunate that Miller used the name *Abies Picea* for the European Spruce, but as Miller did not base his names under Abies on any of the species published previously by Linnaeus under Pinus, his name is not an erroneous transfer, but a new specific name, given by Miller for the reason that Picea was the generally accepted prelinnean name for the Spruce and therefore according to his view the correct name. The objection, however, may be raised against the name *Abies alba* Miller, that it could not be considered a valid name, as it has been formed against the rules, which no doubt is the case, but as the correct combination is preoccupied, it is the next oldest name and therefore the valid name for this species. For those who follow the Philadelphia Code there can be no question that *Abies alba* is the correct name, as the combination *Abies Pice* is preoccupied by an older homonym, and by those who still follow the so-called Kew Rule *Abies alba* is to be accepted as the first name under the correct genus.

**Abies alba** f. **columnaris**, comb. nov. — *Abies pectinata columnaris* Carrière in Rev. Hort. 1859, 39; Traité Conif. ed. 2, 282 (1867). — *Pinus Picea* f. *columnaris* (Carr.) Voss in Putlitz & Meyer, Landlex. IV. 774 (1913).

A form with very short branches of nearly equal length forming a columnar head. There is another columnar form *A. alba* f. *pyramidalis* (Carr.) Voss in which the columnar shape is caused by a different mode of branching similar to that of the Lombardy Poplar.

**Abies lasiocarpa** f. **compacta**, comb. nov. — *Abies subalpina compacta* Beissner in Mitt. Deutsch. Dendr. Ges. IX. 64 (1900); Handb. Nadelholzk. ed. 2, 183 (1909). — *Pinus lasiocarpa* f. *compacta* Voss in Putlitz & Meyer, Landlex. IV. 776 (1913).

This dwarf compact form was first described in 1900 by Beissner who states that he had seen specimens about 1 m. in diameter, but he says nothing about the origin. At the Arnold Arboretum a dwarf compact form was raised from seed sent by Dr. C. C. Parry in 1873 from Colorado. Beissner in 1909 also mentions a similar form originated in 1890 in the nursery of Mr. Ordnung in Eisenberg, Bohemia.

**Picea Abies** Karst. f. **argenteo-spica**, comb. nov. — *P. excelsa argenteo-spica* Hesse apud Beissner, Handb. Nadelh. 367 (1891). — *P. excelsa argenteo-spicata* Beissner in Mitt. Deutsch. Dendr. Ges. VI. 50 (1897); Handb. Nadelh. ed. 2, 240 (1909). — *Pinus Abies* f. *argentei-spicata* Voss in Putlitz & Meyer, Landlex. IV. 770 (1913).

**Picea Abies** f. **cincinnata**, comb. nov. — *Picea excelsa cincinnata* Hesse apud Beissner in Mitt. Deutsch Dendr. Ges. VI. 92 (1897).

**Picea Abies** f. **elegans**, comb. nov. — *Abies excelsa* β. elegans Forbes, Pinet. Woburn, 90 (1839). — *Pinus excelsa elegans* Rinz in Gartenfl. VI. 334 (1857), nomen. — *Picea excelsa elegans* Beissner, Handb. Nadelh. 363 (1891).

**Picea Abies** f. **Ellwangeriana**, comb. nov. — *Picea excelsa Ellwangeriana* Beissner, Handb. Nadelh. 366 (1891). — *Abies excelsa Ellwangeriana* Hort. ex Beissner, l. c., as synon.

**Picea Abies** f. **Merkii**, comb. nov. — *Picea excelsa* var. *Merkii* Beissner in Jaeger & Beissner, Ziergeh. ed. 2, 440 (1884). — *Abies excelsa Merkii* Dieck, Haupt-Cat. Zoeschen, 86 (1885), nom.

**Picea Abies** f. **monstrosa**, comb. nov. — *Abies excelsa* 11. *monstrosa* (Hort.) Loudon, Arb. Brit. IV. 2295 (1838). — *Abies aclada* Savi in Flora, XXVII. 519 (1844). — *Pinus Abies* 11. *monstrosa* Antoine, Conif. 92 (1842–45). — *Pinus Picea* var. λ. *monstrosa* Endlicher, Syn. Conif. 118 (1847). — *Pinus excelsa monstrosa* Rinz in Gartenfl. VI. 334 (1857), nom. — *Picea excelsa* l. *monstrosa* Regel, Russk. Dendr. ed. 2, 33 (1883). — Beissner, Handb. Nadelh. ed. 2, 266 (1909), non ed. 1 (1891), nec 1884, necque *P. excelsa monstruosa* Carrière. — *Picea excelsa* ε. *monocaulis* Noerdlinger apud Willkomm, Forst. Fl. ed. 2, 76 (1887). — Boehm in Zeitschr. Forst. Jagdwes. XXV. 227, fig. (1895). — *Picea vulgaris* f. *monocaulis* Beck, Niederoestr. Fl. I. 7 (1890). — *Picea excelsa* l. *monocaulis* Ascherson & Graebner, Syn. Mitteleur. Fl. I. 198 (1897). — *Picea excelsa* lusus *montrosa* [*sic*] Schroeter in Vierteljahrsschr. Naturf. Ges. Zuerich, XLIII. 170 fig. 18 (Vielgestalt. Fichte, 50) (1898).

The name monstruosa had been applied by Carrière and monstrosa by Beissner in his earlier publications to a sparingly branched form, but Loudon describes a form with a single unbranched thick stem.

**Picea Abies** f. **parviformis**, comb. nov. — *Abies excelsa parviformis* Maxwell in Horticulturist XXIX. 201 (1874). — R. Smith, Pl. Fir. Tribe, 5 (187.?). — *Picea excelsa parviformis* Otto in Hamburg. Gart. Blumenzeit. XXII. 158 (1866), nom. — Beissner, Syst. Einth. Conif. 37 (1887).

**Picea Abies** f. **procumbens**, comb. nov. — *Abies excelsa procumbens* A. Murray, in Ravenscroft, Pinet. Brit. II. 138 (1867). — *Picea excelsa procumbens* Carrière, Traité Conif. 251 (1855).

**Picea Abies** f. **pygmaea**, comb. nov. — *Abies excelsa* 8. *pygmaea* Loudon, Arb. Brit. IV. 2295 (1838). — *Pinus Abies* 8. *pygmaea* Antoine, Conif. 91 (1842–45). — *Pinus Picea* var. θ. *pygmaea* Endlicher, Syn. Conif. 118 (1847). — *Abies pygmaea* (Fisch.) Wenderoth, Pflanz. Bot. Gaert. I. Conif. 17 (1851). — *Picea excelsa pygmaea* Carrière, Traité Conif. 250 (1855). — *Pinus excelsa pygmaea* Rinz in Gartenfl. VI. 334 (1857), nom.

**Picea Abies** f. **pyramidata**, comb. nov. — *Picea excelsa pyramidata* Carrière, Traité Conif. 247 (1855). — *Abies excelsa* Hort. apud Gordon, Pinet. Suppl. 5 (1862). — *Picea excelsa pyramidalis* Vos, Bered. Woordenb. Heest. Conif. 176 (1867). — *Picea excelsa* f. *pyramidalis* Berg in Schrift. Naturf.

Ges. Dorpat, II. 17, t. 6 (1887). — *Picea excelsa* lusus *erecta* Schroeter in Vierteljahrsschr. Naturf. Ges. Zuerich, XLIII. 89 (1898). — *Picea excelsa* var. *europaea* lusus *pyramidata* Schroeter in Ber. Schweiz. Bot. Ges. XIII. 107, fig. 3 (1903). — *Picea excelsa* var. *pyramidalis* subvar. *pyramidata* Schneider in Silva-Tarouca, Uns. Freil.-Nadelh. 230 (1913). — *Picea Abies* var. *pyramidalis* Nash in Jour. N.Y. Bot. Gard. XVIII. 89 (1817).

**Picea Abies** f. **Remontii,** comb. nov. — *Abies excelsa Remontii* R. Smith, Pl. Fir Tribe, 5 (187?). — *Picea excelsa Remontii* Beissner, Syst. Einth. Conif. 37 (1887). — Purpus in Moeller's Deutsch. Gaertn.-Zeit. XXI. 557, fig. 4 (1906). — Schneider in Silva-Tarouca, Uns. Freil.-Nadelh. 230, fig. 206 (1913).

**Picea glauca** f. **aurea,** comb. nov. — *Abies canadensis aurea* Nelson, Pinac. 32 (1866). — *Picea alba aurea* Seneclauze, Conif. 23 (1868). — Beissner, Handb. Nadelh. 343 (1891). — *Picea laxa* f. *aurea* Voss, Vilmorin's Blumengaert. ed. 3, I. 1241 (1896). — *Picea canadensis aurea* Sudworth in U.S. Dept. Agric. Div. For. Bull. XIV. 38 (Nomencl. Arb. Fl.) (1897).

Though the oldest name for the White Spruce is *Abies canadensis* Miller, the specific name "*canadensis*" cannot be used under Picea, as there exists already the older homonym *P. canadensis* Link which is the valid name for the Hemlock Spruce under the genus *Picea*. Therefore the specific name of the next oldest binomial which is *Pinus glauca* Moench (1785) has to be used and the correct name of the White Spruce becomes *Picea glauca* Voss (see also Sargent in Bot. Gaz. LXVII. 208, 1919).

**Picea glauca** f. **coerulea,** comb. nov. — *Abies alba glauca* Dimsdale apud Knight & Perry, Syn. Conif. 36 (1850), nom. — Plumbly apud Gordon, Pinet. 3 (1858). — *Abies alba coerulea* Nelson, Pinac. 47 (1866). — *Picea alba coerulea* Carrière, Traité Conif. ed. 2, 320 (1867), pro parte. — *Picea alba glauca* Hort. apud Sénéclauze, Conif. 23 (1868). — *Picea laxa* f. *coerulea* Voss, Vilmorin's Blumengaert. ed. 3, I. 1241 (1896). — *Picea canadensis glauca* (Moench) Sudworth in U.S. Dept. Agric. Div. For. Bull. XIV. 37 (Nomencl. Arb. Fl.) (1897). — *Picea alba* var. *argentea* Zederbauer in Sitzber. Akad. Wiss. Wien Math.-Nat. Kl. CXVI. 1938 (1907). — *Picea canadensis* var. *coerulea* Schneider in Silva-Tarouca, Uns. Freil.-Nadelh. 224 (1913). — *Pinus glauca* f. *coerula* Voss in Putlitz & Meyer, Landlex. IV. 771 (1913).

This is a form with very glaucous, sometimes nearly silvery white leaves. The varietal name *coerulea* starts with *Abies alba coerulea* Nelson which is not based on any previously published name; the earlier varietal name *glauca* cannot be used, as it would repeat the specific name without designating the type. The plant described as *Abies rubra* var. *coerulea* Loudon, *Picea coerula* Link or *Pinus rubra β. violacea* Endlicher has been often referred to this form, but according to the description it is apparently a form of *P. mariana* Britton, Sterns & Poggenburg.

**Picea glauca** f. **nana,** comb. nov. — *Abies alba* var. *nana* Jacques in Ann. Fl. Pom. V. 326 (1836); Monog. Conif. 67 (1837). — Loudon, Arb. Brit. IV. 2311 (1838). — *Pinus alba nana* Antoine, Conif. 87 (1842–45). — *Pinus*

*alba β. nana* (Loud.) Endlicher, Syn. Conif. 113 (1847). — *Picea alba nana* Carrière, Traité Conif. 239 (1855). — *Abies alba prostrata* Hort. ex Beissner, Handb. Nadelh. 342 (1891), as synonym of *P. alba nana.* — *Picea canadensis nana* (Loud.) Sudworth in U.S. Dept. Agric. Div. For. Bull. XIV. 38 (Nomencl. Arb. Fl.) (1897).

GRAMINEAE

**Sasa Veitchii,** n. comb. — *Phyllostachys bambusoides β. albo-marginata* Miquel in Ann. Mus. Bot. Lugd.-Bat. II. 284 (Prol. Fl. Jap. 172) (1866). — *Bambusa senanensis? β. albo-marginata* Franchet & Savatier, Enum. Pl. Jap. II. 606 (1879). — *Bambusa Veitchii* Carrière in Rev. Hort. 1888, 90. — Watson in Gard. Chron. ser. 3, III. 382 (1888). — *Arundinaria Veitchii* N. E. Brown in Gard. Chron. ser. 3, V. 521 (1889). — *Bambusa albo-marginata* Makino in Descr. Prod. For. Paris Exp. 37 (1900); in Tokyo Bot. Mag. XIV. (62) (1900), nomen. — *Arundinaria albo-marginata* Makino in Tokyo Bot. Mag. XIV. 30 (1900). — *Sasa albo-marginata* Makino & Shibata apud Makino & Shirasawa, Icon. Bamboos Jap. 45, t. 11, figs. 21–27 (1900); in Tokyo Bot. Mag. XV. 25 (1901).

JAPAN.

Makino took up the oldest varietal name for the species, but the existence of a previous binomial makes that new combination inadmissible according to the International Rules, as in the case of the following species.

**Sasa Veitchii f. minor,** n. comb. — *Arundinaria albo-marginata* f. *minor* Makino in Tokyo Bot. Mag. XIV. 32 (1900). — *Bambusa albo-marginata* f. *minor* Makino ex Makino, l. c., pro synon. — *Sasa albo-marginata* f. *minor* Makino & Shibata in Tokyo Bot. Mag. XV. 25 (1901). — *Sasa albo-marginata* f. *nana* Camus, Bambus. 21, t. 3, fig. C (1913).

**Sasa senanensis,** comb. nov. — *Arundinaria kurilensis γ. paniculata* Fr. Schmidt in Mém. Acad. Sci. St. Pétersb. ser. 7, XII. no. 2, 198 (Fl. Sacchal.) (1868). — *Bambusa senanensis* Franchet & Savatier, Enum. Pl. Jap. II. 182, 606 (1879). — Hackel in Bull. Herb. Boiss. VII. 719 (1899). — *Arundinaria palmata* Marliac apud Bean in Gard. Chron. ser. 3, XV. 368, f. 19 (p. 167) (1894). — *Bambusa tessellata* Makino in Tokyo Bot. Mag. IX. 73 (1895), non Munro. — *Bambusa paniculata* Makino in Descr. Prod. For. Paris Exp. 37 (1900); in Tokyo Bot. Mag. XIV. (62) (1900), nomen. — *Arundinaria paniculata* Makino in Tokyo Bot. Mag. XIV. 50 (1900). — *Sasa paniculata* Makino & Shibata apud Makino & Shirasawa, Icon. Bamboos Jap. 47, t. 11, figs. 7–15 (1900); in Tokyo Bot. Mag. XV. 25 (1901). — Camus, Bambus. 24, t. 2, figs. C, D (1913).

JAPAN.

**Sasa senanensis f. nebulosa,** comb. nov. — *Bambusa palmata* f. *nebulosa* Makino in Descript. Prod. For. Paris Exp. 37 (1900); in Tokyo Bot. Mag. XIV (61) (1900), nomen. — *Arundinaria paniculata* f. *nebulosa* Makino in Tokyo Bot. Mag. XIV. 61 (1900). — *Arundinaria paniculata* f. *nebulosa* Makino in Tokyo Bot. Mag. XIV. 52 (1900). — Makino & Shirasawa, Icon. Bambus. Jap. 49, t. 7, figs. 6–9 (sub Sasa in tab.) (1900). — *Sasa paniculata*

f. *nebulosa* Makino & Shibata in Tokyo Bot. Mag. xv. 26 (1901). — *Sasa paniculata* var. *nebulosa* Camus, Bambus. 24 (1913).

**Sasa senanensis** var. **stenantha,** n. comb. — *Bambusa stenantha* Makino in Descript. Prod. For. Paris Exp. 37 (1900), nomen; in Tokyo Bot. Mag. xiv. (62) (1900). — *Arundinaria paniculata* var. *stenantha* Makino in Tokyo Bot. Mag. xiv. 52 (1900). — *Sasa paniculata* var. *stenantha* Makino & Shibata in Tokyo Bot. Mag. xv. 26 (1901). — Camus, Bambus. 24 (1913).

*Sasa paniculata* var. *nana* Makino & Shibata is *S. nana* Makino in Tokyo Bot. Mag. xxvi. 11, fig. 1 (1912). Of *S. paniculata* var. *Ontakensis* (Franch. & Sav.) Camus, Bambus. 24, t. 2, fig. B (1913) and var. *depauperata* Camus, l. c. 25 I am not quite certain if they belong here.

## JUGLANDACEAE

**Carya cathayensis** Sargent, Pl. Wilson. iii. 187 (1916).

This interesting recent addition to the Chinese flora had been known only from the type locality, the mountains round Changhua Hsien in the province of Chekiang, where it was discovered in 1915 by F. N. Meyer and later also collected by D. Macgregor; therefore it was considered a tree of very restricted distribution. A collection of Chinese woody plants, however, recently received at the Arboretum contained a specimen of this species from Kweichou where it had been found by Dr. H. von Handel-Mazetti as a cultivated tree between Kutchou and Liping at an altitude of 950 m. near the village of Mantunggai in the extreme southeastern part of Kweichou near the border of Hunan and Kwangsi. This of course leaves it doubtful whether the tree is growing spontaneously in that region or not, but it seems more likely that it was brought from the neighboring mountains than that it has been introduced from the province of Chekiang, a distance of about 750 miles. If the Chinese Hickory were frequently cultivated by the Chinese, it would seem strange that such a distinct and handsome tree had not been discovered earlier in some of the better explored regions of China. The spontaneous occurrence of *Carya cathayensis* in Kweichou would extend its range southwestward from 119° to 109° E. Long. and would make probable the occurrence of this tree in Kiangsi, Hunan and possibly Kwangsi.

## BETULACEAE

**Carpinus Handelii,** spec. nov.

Arbor " speciosa "; ramuli novelli dense molliter villoso-pilosi, annotini glabrescentes vel glabri, fusco-brunnei, obscure lenticellati. Folia oblongo-ovata vel elliptico-lanceolata, satis longe acuminata, basi leviter obliqua, late cuneata vel subrotundata, 5–10 cm. longa et 1.8–3.6 cm. lata, subsimpliciter mucronato-serrulata dentibus modice inaequalibus saepe fere ad mucronem reductis plerisque nervos terminantibus, nervis utrinque 14–16, supra leviter impressis, subtus prominentibus et trabeculis approximatis elevatis conjunctis, juniora utrinque dense villosa, maturitate chartacea,

supra costa minute puberula excepta glabra, subtus praecipue ad costam, nervos et venulos dense breviter pilosa, in costa pilis sericeis interspersis, in axillis barbulata; petioli 2–4 mm. longa, dense breviter pubescentes. Inflorescentia fructifera satis densa, pedunculo 1.5–2 cm. longo incluso 8–9 cm. longa; bracteae semiovatae, circiter 2 cm. longae et 8 mm. latae, margine convexiore dentatae dentibus paucis latis brevibus interdum fere obsoletis, latere recto integrae vel subintegrae, basi leviter inflexae et basin nuculae amplectentes, basi circiter 5-costatae costis et nervis extus adpresse pubescentibus intus fere glabris; nuculae late ovoideae, compressae, 8–9-costatae, perigonio coronatae, minute pilosulae, apice longius pilosae, resinosae.

CHINA. Hunan: inter urbes Linling (Yungchoufu) et Sinning in silvis collium supra vicum Tjentiesse, alt. 400 m., Aug. 14, 1917, *H. von Handel-Mazetti* (No. 421, type); in silva infra Tungdjiapaï prope minas Hsikwangschan, dist. Hsinhwa, alt. 550 m., May 20, 1918, *H. von Handel-Mazetti* (No. 534, "arbor excelsa").

This is a well-marked species of the section Eucarpinus, characterized chiefly by the rather large, short-petioled, closely veined, nearly simply serrate leaves with small mucronate teeth, by the dense villose pubescence of the young branchlets and leaves, by the short-pilose pubescence of the under side of the mature leaves, silky or wanting in most other species, by the shallowly dentate, not lobed bracts and the minutely pilose resin-dotted nutlets. *Carpinus Handelii* is apparently most closely related to *C. Tschonoskii* Maxim. and *C. polyneura* Franch.; the first differs chiefly in its longer petioles 0.5–1.5 cm. long, in the doubly serrate leaves glabrous beneath except a silky pubescence on the veins, and in the glabrous nutlets; the second species in its smaller, slender-petioled leaves with larger and fewer simple teeth, in the smaller fruiting catkins and in the absence of resin-dots on the nutlets. In the size, shape and serration of the leaves the new species resembles the Himalayan *C. faginea* Lindley, but that species has the leaves glabrous beneath, at least at maturity except the silky-pubescent midrib and secondary veins, and has smaller more sharply serrate-dentate bracts and apparently no resin-dots on the nutlets (only immature fruit seen).

**Betula pendula** Roth f. **viscosa**, comb. nov. — *Betula dentata viscosa pyramidalis* L. Chenault & Fils, Cat. 1912/13, 3. — *Betula verrucosa* var. *dentata viscosa* Bean, Trees & Shrubs, I. 264 (1914).

A slow-growing bushy tree of dense pyramidal habit; young branchlets densely glutinous-verrucose: leaves triangular-ovate, 3–6 cm. long, acuminate, truncate or occasionally subcordate at the base incisely and doubly dentate and lobulate, glabrous with glandular dots beneath; petioles 0.4–1 cm. long. In the shape of its leaves it resembles somewhat *B. alba* var. *urticaefolia* Spach, but it is perfectly glabrous and the branchlets are very resinous. In habit it has some resemblance to *B. pendula* f. *fastigiata* K. Koch, but the leaves are more deeply and coarsely toothed, the petioles are shorter and the branchlets more densely resinous.

(*To be continued*)

# NOTES ON NORTH AMERICAN TREES. V[1]

C. S Sargent

**Populus tacamahacca** Mill. — This name has recently been taken up[2] for the Balm of Gilead or Ontario Poplar, *Populus candicans* Ait. Miller's description, however, of *Populus tacamahacca*, "foliis subcordatis, inferne incanis," applies equally well to the common Balsam Poplar of northeastern North America. In his detailed description Miller speaks of the leaves as "differing from each other in shape and size, most of them almost heart-shaped, but some are oval and rather nearer to spear-shaped. In the Balsam Poplar the leaves vary from ovate to lanceolate, and are subcordate, rounded or cuneate at base, and are not broad-ovate, deeply cordate and abruptly pointed at apex, as are the leaves of *P. candicans* Ait. Miller describes the staminate flowers of his *P. tacamahacca*, but as only pistillate trees of *P. candicans* have been seen, his description of the staminate flowers cannot apply to that species. According to Aiton *P. candicans* was not introduced into England until about 1772, or fourteen years after Miller's description of his *P. tacamahacca* was published. The evidence certainly seems to show therefore that Miller included in his description of *Populus tacamahacca* the different forms of the Balsam Poplar which all authors but Miller have called *P. balsamifera* and for which Miller's name should be adopted.

With the material found in herbaria which I have seen it has not been possible to determine the western range of *Populus tacahamacca*, for without the pistillate flowers or the fruit it is impossible to distinguish this species from the western *P. trichocarpa* Torr., and specimens with leaves only collected in Montana, Idaho, northern California and on the coast of Alaska can be equally well referred to one of these species as to the other.

**Populus tacamahacca** var. **Michauxii** Farwell in Rhodora, xxi. 101 (1919). — *P. candicans* Sargent, Silva N. Am. ix. t. 490, f. 1, 2 (staminate flowers), (1896), not Aiton. — *P. Michauxii* Dode, Extr. Monog. Ined. Populus, 62, (1905). — *P. balsamifera* var. *Michauxii* A. Henry, Gard. Chron. ser. 3, lix. 230 (1916). — This is a common northern variety with cordate or subcordate leaves slightly pilose on the under side of the midribs and veins, and distributed from Aroostook County, Maine, to the Province of Quebec, Newfoundland and the shores of Hudson Bay.

**Populus acuminata** var. **Rehderi**, n. var.

A typo recedit foliis majoribus plerisque longius petiolatis, ramulis junioribus et gemmis pubescentibus, fructibus minoribus.

A large tree with smooth gray or greenish yellow bark, becoming deeply

[1] The preceding parts of this series have appeared in Botanical Gazette: I. Quercus. (lxv. 423-459. 1918). — II. Carya. (lxvi. 229-358. 1918). — III. Tilia. (lxvi. 428-438, 494-511. 1918). — IV. (lxvii. 208-242. 1919).

[2] Farwell in Rhodora, xxi. 101, 1919.

furrowed on old trunks. Leaves 8–11 cm. long and 6–7 cm. wide, their petioles up to 7 cm. in length. Fruit 3–5 mm. long in crowded aments 6–7 cm. in length.

DISTRIBUTION. River banks, Silver City, Grant County, New Mexico, *A. Rehder*, August 10, 1914 (No. 275); *Alice Eastwood*, April and May, 1919 (Nos. 8175, 8176, 8178, 8179, 8201, 8296, 8345, 8347, 8348, 8356, 8357, 8358, 8379, 8383 [type], 8384, 8393, 8423, 8424, 8433, 8453, 8455, 8456, 8479. River banks near Fort Whipple (Nos. 8831 and 8841) and Prescott (Nos. 8853 and 8854), Yavapai County, Arizona, *Alice Eastwood*, May, 1919.

**Populus Fremontii** var. **macrodisca**, n. var.

A typo recedit disco lato et alto capsulam fere includente.

A tree with glabrous branchlets, reddish brown when they first appear, becoming light yellow-brown in their first winter. Leaves broad-ovate, abruptly long-pointed and acuminate at apex, subcordate at the broad base, and gradually narrowed and cuneate to the insertion of the petiole, coarsely crenately serrate, glabrous, 7–9 cm. long and broad; petioles slender, 5–8 cm. in length. Fruit in aments 10–12 cm. long, ellipsoidal, rounded at the ends, 7–8 mm. long, enclosed to above the middle or nearly to the apex in the broad cup-like disk slightly undulate on the margins; pedicels 2–3 mm. long.

DISTRIBUTION. Near Silver City, Grant County, New Mexico, *Alice Eastwood*, May, 1919 (Nos. 8429 [type], 8435).

In the peculiar shape of the base of its leaves this variety resembles *Populus Fremontii* var. *Toumeyi* Sargent which has been collected by Miss Eastwood in the neighborhood of Silver City, but the leaves are larger. The size of the disk under the fruit distinguishes this tree from all other American Poplars.

**Populus balsamifera** Linnaeus, Spec. 1034 (1753). — *P. angulata* Michaux f., Hist. Arb. Am. III. 302, t. 12 (1813). — *P. angulata* var. *missouriensis* A. Henry in Elwes & Henry, Trees of Great Britain, VII. 1811 (1913). — *P. deltoidea* var. *missouriensis* A. Henry in Gard. Chron. ser. 3, LVI. 46 (1914).

The fact has long been known to students of American trees that the *Populus balsamifera* of Linnaeus was one of the Cottonwoods and not the Balsam Poplar of northeastern North America for which Linnaeus's name has long been used, but it is only recently that the correct application of the name has been suggested in print.[1] Linnaeus based his species on the *Populus nigra, folio maximo, gemmis balsamum odoratissimum fundentibus* of Catesby (*Hist. Nat. Car.* I. 34, t. 34). Catesby's specimen from which his figure was made is preserved in the British Museum and through the courtesy of Dr. Rendle the Arboretum possesses an excellent photograph of this specimen which must be taken as the type of *P. balsamifera* Linnaeus. It does not represent the common Cottonwood of the eastern states but a tree which, although widely distributed, is now rare and local. The leaves

[1] Farwell in Rhodora, XXI. 101 (1919).

are ovate, longer than broad, abruptly acuminate at apex, subcordate or rarely truncate at base, finely crenately serrate, 12–15 cm. long and 10–12 cm. wide. The flowers and fruit do not differ from those of the common Cottonwood, and the angular branchlets, which have often been considered a specific character of this tree, have no significance for such branchlets occur on all forms of *P. balsamifera* and on the Rocky Mountain *P. Sargentii.*

I have seen specimens of *P. balsamifera* from the shore of Lake Champlain at Shelburne Point, Chittenden County, Vermont; near Rochester, Munroe County, New York; from an island in the Delaware River above Easton, Northampton County, Pennyslvania; North Bend on the Ohio River, Hamilton County, Ohio; banks of the Potomac River opposite Plummer's Island, about Bare Hills and near Copper Mine, Baltimore County, Maryland; banks of the Chattahoochee River at Columbus, Muscogee County, Georgia; River Junction, Gadsden County, Florida; Starkville, Oktibbeha County, and Artisia, Lowndes County, Mississippi.

The *Populus angulata* of the younger Michaux, although he did not describe or figure the staminate flowers, is probably the *P. balsamifera* of Linnaeus, but it is impossible to determine if the *P. angulata* of Aiton is the *P. balsamifera* of Linnaeus or the tree now cultivated in Europe as *P. angulata,* on which the scales of the flowers are dentate, not fimbriate at apex. Trees with such scales have not been found growing wild in the United States, and it is possible that all the trees with these peculiar scales have been propagated from one abnormal individual. For the common Cottonwood of the eastern states, which differs only from *P. balsamifera* of Linnaeus in its smaller ovate-deltoid leaves, the following name can be adopted:

**Populus balsamifera** var. **virginiana,** n. comb.

*P. deltoidea* Marshall, Arbust. Am. 107, 106 (1785), at least in part. *P. nigra β. virginiana* Castiglioni, Viag. negli Stati Uniti, II. 374 (1790). — *P. deltoidea* var. *angulata* Sargent, Trees and Shrubs, II. 212 (1913), in part.

The leaves of northern trees of this variety are quite glabrous, but south of the Potomac and Ohio Rivers many individuals occur on which the under side of the midribs and principal veins are pilose, especially early in the season. This form, which is probably the *P. angulata* var. *missouriensis* A. Henry in part and the *P. deltoidea* var. *angulata* Sargent in part, may be called

**Populus balsamifera** var. **pilosa,** n. nom.

**Betula papyrifera** var. **elobata,** n. comb. — *B. alba* var. *elobata* Fernald in Rhodora, XV. 169 (1913).

**Betula papyrifera** var. **occidentalis,** n. comb. — *B. occidentalis* Hooker, Fl. Bor. Am. II. 155 (1839). — *B. papyracea* var. *occidentalis* Dippel, Laubh. II. 177 (1892). — *B. Lyalliana* Koehne in Mitt. Deutsch. Dendr. Ges. VIII. 53 (1899), nom. nud. — *B. papyrifera* var. *Lyalliana* Koehne apud Schelle in Beissner, Schelle & Zabel, Handb. Laubholz.-Ben. 55 (1903).

**Betula papyrifera** var. **subcordata,** n. var. — *B. subcordata* Rydberg apud Butler in Bull. Torrey Bot. Club, XXXVI. 496, f. 15 (1909).

This variety of the Canoe Birch differs from the type in the slightly cordate or rounded base of the leaves which are acute on the type specimen but are as often acuminate or abruptly acuminate as acute; the spreading teeth of the leaves, which have been used to distinguish this tree, more often point forward and appear to have no specific importance. The bark separates in thin layers and is usually white but is sometimes on occasional trees dark red-brown or orange color.

This is the common White Birch of the northern Rocky Mountain region from Alberta to northern Montana and Idaho, and westward to eastern Washington, Oregon and British Columbia where it grows with the var. *occidentalis* Sarg. from which it differs chiefly in its smaller leaves subcordate or rounded at base, and its usually smaller strobiles. The leaves of the var. *occidentalis* Sarg. are rounded or cuneate at base, and only rarely cordate usually only on vigorous shoots. The color of the bark, as in *B. papyrifera* and its varieties, differs on different individuals from white to reddish brown and to orange color.

Much reliance has been placed on the color of the bark for distinguishing species among the Canoe Birches which cross the continent in the north, but late collections indicate that this character cannot be depended on. The pubescence on the leaves and branchlets do not furnish specific characters in this group, and the shape of the scales of the mature strobiles, which usually vary in all species of Betula, cannot be used to separate successfully the different varieties of the Canoe Birch as here considered.

**Betula papyrifera** var. **montanensis,** n. var. — *B. montanensis* Butler in Bull. Torrey Bot. Club, XXXVI. 439, f. 17 (1909).

From other forms of *Betula papyrifera* this variety differs in its thicker, darker green leaves and in the unusually long base of some of the mature scales under the nutlets which below the middle of the strobile is rather more than twice the length of the expanded upper part of the scale, while near the apex of the strobile it is only about as long. The leaves of the type of *B. montanensis* from Yellow Bay on the eastern shore of Flathead Lake, Montana, are represented as broadly ovate, truncate at base and acute at apex; and the bark of this tree is described as of the same bronze color as that of *B. occidentalis* but " is dull, never peeled, and is always mottled with gray." What is evidently the same variety was collected by *J. G. Jack* September 13, 1919, at Sandpoint, Bonner County, Idaho, where close to the railroad station are growing a number of trees 14–17 m. tall with white bark. On one of the two branches collected by Mr. Jack the leaves resemble exactly the leaf of *B. montanensis* as figured in the Bull. Torrey Bot. Club, but on the fruiting branch of the same tree the leaves are all coarsely doubly serrate, long-pointed and acuminate, and vary from broad-ovate with a rounded base to oblong-ovate or lanceolate, and narrowed and rounded at base, and are 10–12 cm. long and 4–5 cm. wide. The branchlets during the first season are puberulous. In the stoutness of the mature catkins and in the shape of their scales, and in the shape and thickness of the leaves this appears the most distinct of the different forms of the Canoe Birch.

**Betula fontinalis** Sarg. — The type of this species is from Manitou, Colorado, on the eastern foothills of the Rocky Mountains. The strobiles of some of the Manitou plants are 4 cm. long and 10 or 12 mm. in diameter; on other plants in the same locality the strobiles are only 2.5 cm. long and 5 mm. in diameter. Specimens from other parts of Colorado show a similar variation in the size of the strobiles. The length and thickness of the strobiles and the shape of their scales have been used to distinguish *B. Piperi* Britt. from *B. fontinalis*. The longest strobiles of *B. Piperi* are 4 cm. long and 5 cm. thick and are longer than the longest of *B. fontinalis*, but the size of the strobile varies so much on different individuals that it has no value in distinguishing species. The shape of the scales of the strobiles has also been used as a character for distinguishing *B. Piperi* from *B. fontinalis*, those of *B. fontinalis* being described with " lateral lobes ascending or erect, shorter than the middle one," and those of *B. Piperi* with " lateral lobes widely spreading and obtuse, about as long as the narrower acute middle one." These descriptions are true of the scales of some individuals, but, as in other species of Betula, the scales vary greatly in shape, and scales of the two forms occur on thick and slender strobiles, and often on the same tree.

*Betula Piperi* is a tree sometimes 16 or 17 m. high, with a tall single stem occasionally 3 dm. in diameter. On the strength of its habit therefore *B. Piperi* had perhaps best be distinguished as

**Betula fontinalis** var. **Piperi**, n. var. — *B. Piperi* Britton in Bull. Torrey Bot. Club, XXXI. 165 (1904).

This appears to be a rare and local tree and to be confined to western Washington where it occurs in the neighborhood of Pullman and Almota, Whitman County, and at Spokane, Lincoln County, where it probably grows to its largest size.

The Birch of this group from California has the short slender catkins of some of the Colorado specimens of *B. fontinalis* and probably should be referred to that species.

I have seen Californian specimens from Sisson, Siskiyou County, *J. G. Jack*, August 26, 1907; Metcalf's ranch, northeast base of Mt. Eddy, Siskiyou County, *A. A. Heller*, No. 12, 133, July 18, 1915 (in Herb. Arnold Arboretum); Upper Sacramento River, Butte County, *W. R. Dudley*, August, 1899; Lone Pine Canyon and Cottonwood Canyon, Inyo County, *E. L. Morris*, April 3, 1905; near Sisson and Salmon Mountains, Siskiyou County, *W. R. Dudley*, August 3, 1899, and August 26, 1901; Upper Sacramento River below Sheldon's Mill, *W. R. Dudley*, August, 1897; Wyand Creek Canyon near Deep Springs Valley, Inyo County, *Roxana, S. Ferris*, July 15, 1918; Round Mountain, *J. F. Phares*, August, 1915; Silver Canyon in the White Mountains east of Laws, Inyo County, *A. A. Heller*, No. 8266, May 9, 1906 (all in Dudley Herbarium, Leland Stanford Jr. University).

# NOTES

**Arboretum Expedition to Eastern Asia.** After an absence of twenty-six months passed in the Japanese Empire Mr. E. H. WILSON returned to the Arboretum on March 17. He had passed 1914 in Japan, and his last journey was undertaken for the purpose of exploring the forests and studying the trees of outlying parts of the Japanese Empire, Korea, the Bonin, and Liukiu Islands, and Formosa. From his last journey Mr. Wilson has brought to the Arboretum 30,000 herbarium specimens, 700 photographs of trees and types of vegetation, and a large collection of seeds and living plants. A picture of every conifer and Taxad of the Japanese Empire, and of every other native tree of Japan proper, Korea, and the Bonin Islands and of most of the trees of Formosa and the Liukiu Islands is found in the Arboretum collection of photographs which offers a good opportunity to study these trees as they grow naturally in their native forests, and well supplements the photographs of the vegetation of western China made by Mr. Wilson during his two journeys in Hupeh and Szechuan for the Arboretum.

From the seeds collected by Mr. Wilson on his last journey a large number of plants have already been raised, including many now first cultivated in western gardens. Of the plants introduced the most important is *Taiwania cupressoides* Hayata, the Redwood of Formosa, the tallest tree in the world outside of California and Australia, and in its young state one of the most beautiful of all conifers. Seeds of Taiwania have been distributed by the Arboretum to Botanic Gardens in every country in the world where there is a chance that this tree may grow. There are also a few young plants of Taiwania in the Arboretum nursery which can be increased from cuttings in case the seeds, which appear to have a low germinating power, do not produce plants. Seeds of three other important Formosa conifers, *Picea morrisonicola* Hayata, *Abies Kawakamii* Ito, and *Cunninghamia Konishii* Hayata, were also collected by Wilson and have been widely distributed. As a result of Mr. Wilson's visit to the Liukiu Islands the Arboretum has been able to distribute the seeds of *Pinus luchuensis* Mayr. In the Bonin Islands a supply of seeds of the endemic *Juniperus taxifolia* Hooker and Arnott was secured and has been distributed. At least two different plants have been cultivated under the incorrect name of *Juniperus taxifolia*, but this is the first time that seeds have been collected of this interesting Juniper which has not been seen before by an American or European botanist since 1827 when Captain Beechey visited the Bonin Islands.

**Assistant Director of the Arboretum.** — Since his return Mr. E. H. WILSON has been appointed by the President and Fellows of the University Assistant Director of the Arboretum.